

COMPETITION AND ATHLETE ENGAGEMENT TO IMPROVE NUTRITION:  
A USABILITY STUDY OF THE MOBILE APPLICATION BSUATHLEATS

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### Abstract

**THESIS:** Competition and Athlete Engagement to Improve Nutrition: A Usability Study of the Mobile Application BSUathLEATS

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Athletic programs are big businesses for universities. With revenue more than \$100 million at the top universities, programs are driven to seek any competitive advantage possible for enhancing their ability to recruit, train, and produce elite athletes. Since a landmark ruling by the National Collegiate Athletic Association (NCAA) in 2014, nutrition has become another key component of many universities' athlete recruiting and training strategies. With the ubiquity of mobile devices and ease of access to developers, athletic programs have also incorporated custom mobile apps into their offerings. Facilities and personnel require significant capital investments, whereas mobile apps offer a financially viable opportunity to provide athletes the information and support they require to better understand how nutrition and diet affects their performance. Developed at Ball State University, BSUathLEATS represents a low-cost disruptive innovation for college athletic programs and their athletes. This thesis aims to understand and evaluate the extent to which the functionality and user interface design, social aspects and community engagement opportunities, and competitive game-based structure all affect the users' perceptions of enjoyment, engagement, and usability related to BSUathLEATS.

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## Chapter 1: Introduction

Athletic programs are big business for universities. For the 2016-17 fiscal year, National Collegiate Athletic Association (NCAA) Division I member institutions generated more than \$10.38 billion in total revenue<sup>1</sup>. The University of Texas at Austin held the first position, with \$214.8 million (2017 NCAA athletic department revenue database, 2018). When Butler University advanced to the NCAA Men's Basketball Tournament Final Four in 2010 and 2011, analysts estimated the university received more than \$677 million in free publicity, along with increased applications and improved student enrollment (Tuttle, 2016). Northwestern University appeared in the Rose Bowl in 1996 and moved to ninth place from thirteenth on the *US News and World Report* college rankings (Fisher, 2009). In 2018, Ball State University received a \$1.1 million payout from Notre Dame University for a single NBC-televised football game in South Bend, Indiana (O'Gara, 2018). Deals made through 2022 ensure the university will earn an average of \$1.1 million for each of the eight football games against teams from the major conferences. For an institution with approximately \$26.1 million in annual revenue and \$27 million in expenses (2017 NCAA athletic department revenue database, 2018) for 18 teams, these deals are necessary to cover the basic necessities like team travel, coaches' salaries, facilities, and game day operations.

Regardless of whether an institution's athletics program generates millions of dollars in sponsorship deals and ticket revenue, relies on student fees to subsidize expenses, or operates with a revenue deficit, the programs are an integral part of the institution's culture and community outreach. Athletics serves as the "front porch" of the institution and often defines the

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<sup>1</sup> "The data, updated for 2017, is based on the revenue and expense reports collected from more than 225 public schools in the NCAA's Division I that have an obligation to release the data (the NCAA does not release the data publicly). The others are private or are covered under a state exemption" (USA TODAY Sports, 2018).

perception and identity of the university (Suggs, 2003, para. 4). At a Ball State Board of Trustees meeting in 2015 during discussions of the 2015-16 fiscal year athletics budget, then-trustee Frank Hancock said “athletics, we feel, I feel, is an important part of this university, an important part of student life. If you’re going to have athletics programs, we’ve got to do our best to support it” (Slabaugh, 2015, para. 9, 11). At Ball State, a large portion of that support is funded by student fees. For the 2015-16 budget, each student contributed roughly \$610 and accounted for 56 percent of the \$23.8 million budget (Slabaugh, 2015).

With the potential for financial rewards, national recognition, academic success, or to maintain the institutional identity, programs are driven to seek any competitive advantage possible for enhancing their ability to recruit, train, and produce elite athletes. State-of-the-art facilities, highly trained coaches and staff (“Build it and they will come,” 2015), success stories of former athletes, and the latest technology to analyze and improve performance are commonplace in the top-rated programs (Wong, 2015). For example, in 2017, the Clemson Tigers opened a \$55 million football facility after winning the College Football Playoff Championship. It serves as the cornerstone of their recruiting efforts and an example of the measures programs will take to ensure a winning season. The facility includes an indoor slide, nine-hole miniature golf course, wiffle ball diamond, and a 23,000 square foot weight room, among other amenities (Gaines, 2019). At the Oregon Ducks \$68 million Hatfield-Dowlin Complex funded by the co-founder of Nike, players can lounge in Ferrari leather chairs, shower in marble bathrooms, and play on handcrafted foosball tables from Barcelona (Uthman, 2013).

Since a landmark ruling by the National Collegiate Athletic Association (NCAA) in 2014, nutrition has become another key component of many universities’ athlete recruiting and training strategies. Weeks after Shabazz Napier – a guard from the University of Connecticut’s

2013 championship basketball team – reported he was unable to afford food and often went to bed hungry (USA TODAY Sports, 2014), the NCAA approved legislation to address the well-being of athletes and provided new opportunities for how they were fed (Brutlag Hosick, 2014). Prior to the rule change, institutions could only provide snacks, specifically fruit, nuts, and bagels (without any spreads like cream cheese or peanut butter), and a limited number of meals (Infante, 2012). Institutions were also free to explore new ways to develop a sense of community and shared experiences focused on nutrition. Before 2014, only athletes on the same team and those on a scholarship were able to eat together (Myerberg, 2015). Within one year of the ruling, Division I schools increased nutrition-related expenses by 145 percent, from \$534,000 to more than \$1.3 million. Across the country at institutions in the Power Five conferences (Atlantic Coast, Big Ten, Big 12, Pac-12, and Southeastern), nearly all athletes received meals, an increase on average from 368 athletes to 569. In less than six months, full-time sports dietitians were hired at 15 schools, and four others were promoted from part-time employment status (Markey, 2015).

Research has also shown that Division I athletes who have the proper support, education, facilities, and opportunities related to nutrition and health perform better on and off the field of play. A search on Google Scholar for “Division I athlete nutrition science” yields more than 3,400 results published since 2015 and includes topics like hydration, nutrition knowledge, performance, and eating disorders. According to a joint statement from the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine, the “performance of, and recovery from, sporting activities are enhanced by well-chosen nutrition strategies” (Thomas, Erdman & Burke, 2016, p. 501). Although a critical component of the overall success and performance of the athlete, research also shows they lack the knowledge and



resources to adhere to a proper diet regimen (Andrews, Wojcik, Boyd & Bowers, 2016), maintain the proper weight and physical conditioning for competition (Dunn, Turner & Denny, 2008), and properly respond to injuries and recovery (Torres-McGehee, et al, 2012).

Institutions in the Power Five conferences have spent millions on state-of-the-art facilities and programs, private chefs and gourmet meals, and full-time dieticians and nutritionists to feed, support, and educate athletes. For example, at the University of Texas, a \$7.5 million nutrition center at the football stadium provides a variety of opportunities for more than 500 student athletes. With a focus on both education and personalized meals, the center serves as a “learning lab” where athletes can learn how to grocery shop for healthy items on a limited budget, read nutrition labels, and cook meals through hands-on courses (Parlapiano, 2017, para. 3). For the University of Nebraska, the 2017-18 athletics’ program budget included \$3.3 million for high-quality foods, more than a dozen staff, and refueling stations. At the University of Alabama, a \$3.6 million annual budget provides athletes with personal chefs, special dining facilities, individually tailored menus, and on-site nutritionists and dieticians (Olson, 2017). In 2018, Alabama unveiled a \$14 million, 25,000-square-foot facility with fueling centers, smoothie bars, five performance chefs, four dietitians, and outdoor patios (Jones, 2018).

However, without the funding and revenue generated by top programs like basketball and football, lucrative sponsorship deals from shoe and apparel companies, or wealthy donors, small to mid-sized programs struggle to compete against those programs. At Ball State University, part of the Mid-American Conference (MAC), athletes have access to one nutritionist who is available twice a month for eight hours each day during the months of January through April (Stephanie Martin, personal communication, April 1, 2019) for approximately 466 athletes (Myranda Harrison, personal communication, February 18, 2019). The University of Akron

(MAC), which has an annual revenue of approximately \$35 million and operates at a deficit, allocated less than \$100,000 in 2017 to cover food for athletes as they traveled for road games and matches. That same year, Ohio University (MAC) spent less than \$35,000 to provide a snack station for athletes with “dry food items and fruit” (Olson, 2017, para. 21).

With the ubiquity of mobile devices and ease of access to developers, athletic programs have also incorporated custom mobile apps into their offerings. The University of California, Los Angeles, Auburn University, and University of Kansas offer or have offered apps to their athletes to provide basic nutrition guides, recommended menu items from conference restaurants, or on-campus dining options (Gottlieb, 2017; Macias, 2015; “Jayhawk Fuel App”, 2015). Facilities and personnel require significant capital investments, whereas mobile apps offer a financially viable opportunity to provide athletes the information and support they require to better understand how nutrition and diet affects their performance. With limited resources, Ball State Athletics looked to provide their athletes with an app similar to UCLA, Auburn, and Kansas. During the Fall 2017 semester, 15 graduate students in the Emerging Media Design and Development graduate program, a multidisciplinary program within the College of Communication, Information and Media, sought to understand several key factors for nutrition programs, education, and athlete support at Ball State. They conducted design thinking activities, empathy research, and prototype testing with athletes, coaches, and support staff to determine whether existing apps truly met the athletes’ needs. First, they explored the importance of nutrition education and knowledge for coaches, training staff, and college athletes with a focus on how that affects performance. Second, they understood the resources limitations in terms of both human and financial capital at the institution. Finally, they identified motivating factors and activities to encourage and promote participation from the athletes throughout the year, regardless of whether they are in-season or

out of season. The research and direct feedback from 60 athletes and 20 coaches led to a three-part plan created to educate, engage, and promote activities and experiences for all members of the Ball State Athletics department.

At the conclusion of the semester, the mobile app BSUathlEATS emerged as one component of the project design and was further developed in conjunction with the graduate students, athletes, and professional staff in Information Technology. The app represents a low-cost disruptive innovation for college athletic programs and their athletes. With the financial disparity in college athletics and the inadequacies of consumer-market mobile apps for athletes, the opportunity exists for a digital disruption in this market. A “disruptive product addresses a market that previously couldn’t be served or it offers a simpler, cheaper or more convenient alternative to an existing product” (Rachleff, 2013, para. 3).

Created and developed with user-centered design techniques, BSUathlEATS provides athletes with opportunities to improve nutrition through competition and incentives. Rather than focus on static information like recipe guides and menus or existing features like food trackers, the app embraces the intrinsic competitive nature of athletes and educates through activities and community engagement. Based on the existing team structure in the program, teams are divided into three conferences and compete against one another in a series of weekly matchups through individual and team-based challenges and activities. The round-robin conference play leads up to a single-elimination tournament and championship rounds at the end of the season. The winning team and individual male and female MVPs would earn NCAA-compliant rewards, most likely centered on a special meal or gear. To support the sense of community and engagement, a social feed provides athletes with frequent updates from teammates and fellow competitors. Athletes can comment on posts generated by the photo-based challenges, share content to external

sources, and create a list of favorite posts to save recipes or training ideas for a later time. Gamification strategies encourage and motivate athletes with leaderboards, badges, team captains, and other incentives.

This thesis aims to understand and evaluate the extent to which 1) the functionality and user interface design, 2) social aspects and community engagement opportunities, and 3) competitive game-based structure all affect the users' perceptions of enjoyment, engagement, and usability related to BSUathLEATS. To achieve these goals, task-based usability testing, beta testing, mobile analytics, crash reports, a diary study, surveys, and semi-structured interviews were designed to answer three research questions:

**RQ1:** To what extent do the functional aspects of BSUathLEATS affect users' perceptions of enjoyment, engagement, and usability?

**RQ2:** To what extent do the social aspects of BSUathLEATS affect users' perceptions of enjoyment, engagement, and usability?

**RQ3:** To what extent do the competitive aspects of BSUathLEATS affect users' perceptions of enjoyment, engagement, and usability?

Based on prior research and a strong background in mobile app development, this thesis hypothesizes the following for each of the research questions:

**H1:** The functionality and overall design aesthetics will play a significant role in providing a positive user experience.

**H2:** The features found in mainstream social media platforms, such as posts, comments, sharing, and liking will appeal to student-athletes as members of Generation Z.

**H3:** Features like leaderboards, matchups, badges, and points will appeal to the competitive nature of student-athletes and positively affect the user experience.

This thesis makes three key contributions to the usability and viability of a competitive game-based mobile app for collegiate student-athletes and their respective athletic programs: 1) findings from this study should demonstrate how involvement and feedback from student-

athletes leads to a more enjoyable app experience through an understanding of the features and functionality that motivate and encourage student-athletes; 2) understand how concepts from social networking and games can create a more enjoyable app experience and connect to aspects of their daily routines; and 3) explore the potential for low-cost disruptive mobile apps to provide health and nutrition benefits for student-athletes. To understand the factors that motivate and encourage student-athletes to adopt a new product, user-center design, user experience design, and usability principles are used to involve those users throughout each phase of the design and development. By focusing on their unique needs and expectations, how they interact with the product, and the ease at which they interact, there is a greater likelihood of success and a “more efficient, satisfying, and user-friendly experience” (“Introduction to User-Centered Design,” 2015, para. 1).

Student-athletes lead busy lives with the demands of academics and athletics accounting for 40-60 hours of their week (Johnson, 2016). The pervasiveness of mobile technologies, sense of community offered by social media, and student-athletes’ inherent competitive nature offer the opportunity to create an experience that fits into that lifestyle. A 2018 survey from Fieldhouse Media indicated nearly all the 2,136 student-athletes who responded have an account for Facebook, Instagram, Twitter, and Snapchat. With an emphasis on visual media, Instagram was identified as the favorite and draws one to five posts from 93 percent of the student-athletes and 85 percent scroll through their feed at least five times per day (“2018 Survey Results,” 2018).

Finally, this thesis is important because it offers the potential to introduce a low-cost disruptive mobile solution for institutions unable to afford multimillion-dollar training facilities with the latest technology and equipment, hire personal chefs to serve student-athletes gourmet

nutritious meals, and offer refueling and snack stations stocked with a variety of foods and drinks. In the absence of those amenities, student-athletes, coaches, and trainers seek resources that can improve performance and nutrition, whether through online resources, part-time nutritionists, or consumer apps like MyFitnessPal, RunKeeper, and food journals. Institutions have attempted to create custom mobile experiences for student-athletes with menus for on-campus dining facilities, nutrition guides, and restaurant recommendations when teams travel. Those apps are either no longer available for download or offer stale content. BSUathLEATS offers a different approach to provide health and nutrition resources for student-athlete and this thesis explores the findings and recommendations on how they perceive and engage with that solution.

The remainder of this thesis is structured as follows: Chapter 2 provides a review of literature for three key areas of study related to user-centered design, human-computer interaction, and gameplay and motivation. Chapter 3 outlines the methodology used to test the usability of BSUathLEATS. It will outline a task-based usability study to evaluate the initial design and implementation of BSUathLEATS to uncover strengths and weaknesses in the onboarding process, user interface design, and overall gameplay. A second study conducted beta testing with a group of athletes to test the app in real world situations and as part of the athletes' daily routines. The beta testing included a diary study, usage and user experience surveys, mobile analytics, crash reports, and semi-structured interviews. Chapter 4 reports the results from those instruments. Finally, Chapter 5 discusses the lessons learned from the results, future development efforts to improve BSUathLEATS, additional gameplay elements to encourage engagement, potential areas for further research, and opportunities to expand the mobile app to other athletic programs.

## **Chapter 2: Literature Review**

This literature review examines four key areas related to evaluating the design and development of the mobile app BSUathlEATS: 1) how user-centered design principles lead to a positive user experience, 2) how social networking concepts facilitate connections and engagement, 3) how elements of gameplay tap into the competitive nature of student-athletes, and 4) state-of-the-art nutrition support available to student-athletes.

### **How user-centered design principles lead to a positive user experience**

Defined as Generation Z, today's typical college student was born around 9/11 and into a world where social media, mobile devices, and the internet (Dimock, 2019) were as commonplace as indoor plumbing and electricity. Nearly all of them (98 percent) own a smartphone (Young, 2017), with the Apple iPhone in control of 59 percent of the market (App Annie, 2017). Although research indicates their average attention span is eight seconds (Fieler, 2016), they are highly selective in the content they consume. They want to feel engaged through great experiences, meaningful interactions, and personalized content (Ghausi, 2018). YouTube, Instagram, Facebook, Snapchat, and Twitter dominate the most used apps on their phone (Bazilian, 2017), and over 50 percent of daily app engagement occurs within the top 10 apps (Comscore, 2016). The remaining apps face intense scrutiny – 62 percent will uninstall an app if it is hard to navigate, 60 percent if it is too slow (“Despite Living a Digital Life,” 2017), and 21 percent if they do not like how the icon looks on their home screen (Comscore, 2017).

These are exacting standards and at the forefront of challenges faced by mobile app developers, designers, and marketers. With more than 10 million apps on the Google Play Store and Apple App Store (“App stores,” 2018), more than 197 billion app downloads worldwide (“Annual number of mobile app downloads,” 2018), and time spent using apps estimated to

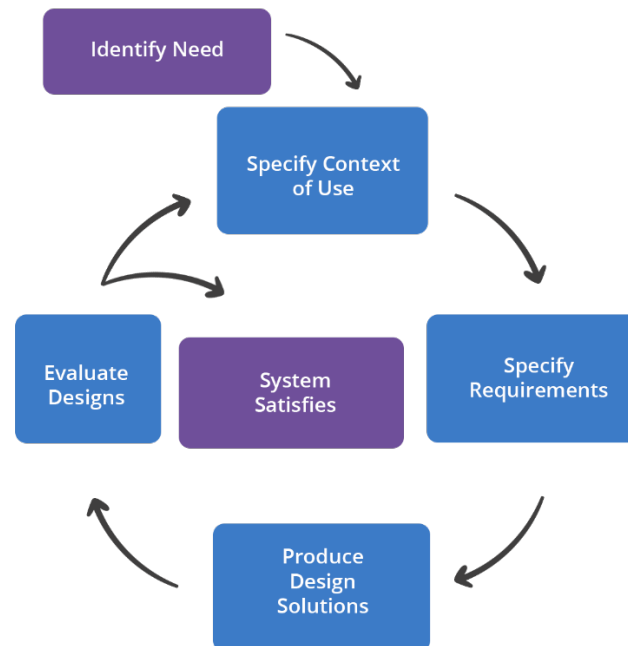
reach 3.5 trillion hours globally by 2021 (App Annie, 2017), it is a daunting task to capture and sustain interest. To provide a positive user experience and connect with the sophisticated market of today's users, app creators must rely on the principles of both user centered design (UCD) and user experience design (UXD).

### *User-Centered Design*

The term “user-centered design” is based upon “an explicit understanding of users, tasks, and environments; is driven and refined by user-centered evaluation; and addresses the whole user experience” (“User Centered Design Basics,” n.d., para. 2). With a basis in the international standard 13407, usability.gov identifies four primary activities involved in UCD and the iterative nature of the process (see Figure 1):

1. Specify the context of use: Identify the people who will use the product, what they will use it for, and under what conditions they will use it.
2. Specify requirements: Identify any business requirements or user goals that must be met for the product to be successful.
3. Create design solutions: This part of the process may be done in stages, building from a rough concept to a complete design.
4. Evaluate designs: Evaluation - ideally through usability testing with actual users - is as integral as quality testing is to good software development.





**Figure 1.** User Centered Design process (“User-Centered Design Basics,” n.d.).

### *User Experience Design*

Where UCD defines the process or strategy used to develop software, user experience design focuses on the framework for how the user interacts with the software. That interaction is the user experience and is defined as a “person’s perceptions and responses resulting from the use and/or anticipated use of a product, system, or service” (ISO 9241-210:2010, 2010, “2.15 User Experience”, para. 1). The international standard further states that the user experience includes “all the users’ emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviours and accomplishments that occur before, during and after use” (2010, “2.15 User Experience”, para. 1) Those reactions are influenced by the branding and the image the software portrays, the features and functionality present or missing, how well the system responds and handles crashes or unexpected behavior, and how users are guided through the experience. The user experience is assessed through a number of methods, including usability

studies, beta tests, surveys, interviews, and analytics (ISO 9241-210:2010, 2010). “Beta testing” is a software development term where the software is released to a controlled group of users to use in real-world situations to collect “feedback on design, functionality, and usability” (“What is Beta Testing?” 2019, para. 5) to assess the quality of the product, identify problems, and provide opportunities for further development and refinement. While beta software may still contain bugs or problems, the feature set and system capabilities are in place and should function as intended.

According to Peter Morville, user experience is influenced by seven factors that create the “User Experience Honeycomb” (2004, para. 3) of UXD (see Figure 2). Those factors include:

1. Useful: Does the software serve a purpose and meet users perceived or defined need?  
Useful can serve a functional or aesthetic role for users.
2. Usable: Does the software work as intended?
3. Desirable: Do users want the software and do they appreciate elements of emotional design like brand, identity, and image?
4. Findable: Can users navigate the interface and find the information necessary to interact with the software?
5. Accessible: Can users with disabilities perform the necessary tasks within the software?
6. Credible: Do users trust the software and the content?
7. Valuable: Does the software provide value to both the organization and users?



**Figure 2.** Peter Morville’s User Experience Honeycomb (Morville, 2004).

The honeycomb provides three key benefits to software developers, designers, and others involved in the software development lifecycle (SDLC). First, it illustrates that usability is only one component of the overall user experience. Second, it helps define priorities and create a modular approach to software development (Morville, 2004). Depending on the target user audience, certain modules may become more or less important than others. For example, BSUathlEATS was developed by professional staff members in the information technology department at Ball State. Student-athletes are the target audience for the mobile app, so there may already exist a level of credibility for the app. Instead the factors of useful and usable, which are evaluated through activities like design thinking, empathy research, and prototype testing, and findable become key areas to focus on during user testing. For example, identified as an “indispensable element of mobile applications” (Kataria, 2019, para. 1) the process of onboarding introduces users the structure, navigation, and potential benefits (Harley, 2014).

Third, each facet offers the opportunity to understand and test the software using specific tools, analyses, and protocols (Morville, 2004).

### *Usability*

As part of the overall user experience, usability refers to how easy users can access and/or use software. To determine usability of software, a proper and thorough evaluation of its “features, together with the user, what the user wants to do with it, and the user’s environment in performing tasks” (Soegaard, 2019, para. 4) is required. This evaluation occurs throughout the ideation, design, development, and continued refinement of the software. There are no strict guides or heuristics that dictate the proper way to conduct usability testing (Kuniavsky, 2003) as each project team, development cycle, and defined deliverables are unique and introduce a specific set of opportunities, constraints, user expectations, and objectives. Additionally, it is important to gauge the quality of the user experience through the “aesthetics of interaction.” This is a concept defined by physical actions like swiping, tapping, and turning balanced with the emotional and personal response from an experience - the way it feels, subjective perceptions, and reflective observations (Lenz, Diefenbach & Hassenzahl, 2013, p. 126). For example, current design trends recommend the use of the bottom nav bar as Gen Z users prefer to navigate, scroll, and tap with their thumbs (Coster, 2017).

Although the exact steps for a usability study vary (Kuniavsky, 2003; Loranger, 2016) and depend on the scope, complexity, and available resources, proper preparation is a key requirement for a successful study. The Nielsen Norman Group recommends the following steps when planning a usability study (Loranger, 2016): define goals for the study, determine the format and setting of the study, determine the number of participants and recruit the right

participants, write tasks that match the goals of the study, conduct a pilot study, decide on collecting metrics, and write a test plan.

*Define goals for the study*

Goals for the study may include the evaluation of frequently used features, navigation and information architecture, and tactics used to create an overall positive experience (Kuniavsky, 2003). A narrow focus on the required goals is necessary, as additional questions take more time to answer and can reduce the overall quality of the study (Loranger, 2016). The results of that analysis serve as relevant considerations for the development team and offers insight into the learnability of the features and uncovers participant awareness of key elements of the app (Tullis & Albert, 2013).

*Determine the format and setting of the study*

The format and location of the study may include field-based studies or in a lab, moderated or unmoderated, and in-person or remote. Each option offers pros and cons for the overall quality of the study and data; however, the ideal situation is an in-person, moderated experience as it offers more insight, personal connection, and opportunities for further conversations (Loranger, 2016).

*Determine the number of participants and recruit the right participants*

The number of participants for a study depend on the type of study being performed. The most important factor is to recruit a representative sample of the target audience. Kuniavsky suggests casting a wide net to attract potential participants, conduct introductory interviews, analyze the responses, and select the best candidates (2003).

*Write tasks that match the goals of the study*

Tasks for the study should reinforce the defined goals and are best presented as scenarios to the participants. They should not lead the participant in a certain direction or use contextual clues that could influence their actions and responses (Loranger, 2016).

*Conduct a pilot study*

Prior to the start of the study, a pilot study may help uncover deficiencies, understand points of confusion with the tasks, and confirm the timing of the study.

*Decide on collecting metrics*

If the study is qualitative, metrics are not a key consideration as the focus is to gain a deeper understanding of the participants' reaction and insights into the software. For quantitative studies with defined tasks, metrics are important and the researcher must define the collection protocols and measurement techniques. Typical measurements include task error rates, satisfaction ratings, time on task (Tullis & Albert, 2013), how efficiently a user can perform a task, and the overall learnability of the task (Kuniavsky, 2003).

*Write a test plan*

Once the researcher defines the process, a test plan is written to properly communicate the procedures to the participants and ensure a consistent experience throughout the study (Loranger, 2016). Kuniavsky identifies several techniques and practices for researchers, including setting up a testing environment with the necessary technology and recording equipment, writing and adhering to a script to maintain consistent interviews, and encouraging participants to use the "think aloud" method where they narrate their thought process and reactions (2003).

### **How social networking concepts facilitate connections and engagement**

For the 98 percent of Generation Z who own a smartphone (Young, 2017), 51 percent spend more than five hours per day on their devices. They are immersed in a carefully curated digital world of media, information, and communication. Each app, platform, and experience are selected to provide a specific need through a specific interaction (Villa, Denison & Dorsey, 2018). This is especially true for the four primary social media platforms – Facebook, Twitter, Instagram, and Snapchat. Based on a survey of 1,000 members of Gen Z, the authors of a yearly study concluded that “regardless of the platform they choose, social media is the best way to reach, communicate with, and understand Gen Z” (Villa, Denison & Dorsey, 2018, p. 11). For example, Facebook is used to communicate with older relatives and family members (Hockstein, 2018) or learn about events (Villa, Denison & Dorsey, 2018). Snapchat is the primary platform for “in the moment” interactions with friends (Hockstein, 2018, para. 4) and where they can post videos or selfies (Villa, Denison & Dorsey, 2018). Instagram is the platform for photos (Villa, Denison & Dorsey, 2018) and to follow brands (Hockstein, 2018). While they gravitate toward these platforms, social networks extend to other apps and are based on the nature of the communication and the purpose of the app (Hockstein, 2018). Across all platforms, this generation values visual media as the primary source of expression, with written social interactions as a secondary form of communication (Hodak, 2018).

Student-athletes reportedly spend 40-60 hours per week engaged in academic and sport-related activities (Johnson, 2016), however they still find time to stay connected to social media. According to a 2018 survey of 2,136 student-athletes (72 percent from NCAA Division I institutions; 68 percent female and 32 percent male), 71 percent spend at least one hour per day on social media and 32 percent two hours or more. Nearly all respondents have an account on

each of the four primary platforms and Instagram was identified as both the most used and favorite platform. With an emphasis on visual media, Instagram draws one to five posts from 93 percent of the student-athletes and 85 percent scroll through their feed at least five times per day. Sixty-seven percent send more than ten snaps per day through Snapchat (“2018 Survey Results,” 2018), an app where users send and receive photos and videos with added filters, special effects, and lenses that expire when viewed (“What is Snapchat?” n.d.). The dynamic between Gen Z student-athletes, their social media tendencies, and propensity for highly selective attention spans, demands communication and engagement that is direct and to the point (Gould, Nalepa & Mignano, 2019), with visual and engaging media.

This method of communication is one reason for the recent expansion of nutrition and health care information in social media (Helms & Jones, 2016). Regardless of whether the institution offers sports nutritionists or dietitians, student-athletes turn to social media for a convenient, “comprehensive, up-to-date, and well-balanced nutrition resource” presented in a “visually appealing and interesting way” (Bourke, Baker & Braakhuis, 2018, p. 4). Photos of meal and snack ideas, recommendations from friends and family, and nutrition trends are popular sources of information. However, frequent concerns expressed by student-athletes are the validity and trustworthiness of the information available through public social media networks (Bourke, Baker & Braakhuis, 2018). For example, a search on Instagram yielded more than 8 million posts for the hashtag #EatHealthy, 5 million for #Whole30, and a half million for #SportsNutrition. With an overwhelming amount of information available, student-athletes are more likely to view friends, family, and teammates as more reliable sources of information (Bourke, Baker & Braakhuis, 2018).



### **How elements of gameplay tap into the competitive nature of student-athletes**

In recent years, the concept of gamification has become a frequently used approach for mobile app developers and designers to attract users, increase engagement, and provide compelling and meaningful experiences. Zichermann & Cunningham (2011) define gamification as “the idea of using game-thinking and game mechanics to solve problems” (p. xiv) and engage audiences through the use of “reward structures, positive reinforcement, and subtle feedback loops, alongside functions like points, badges, levels, challenges, and leaderboards” (p. ix). A second definition adds clarification with the inclusion of “the use of game design elements within non-game contexts” (Deterding, Dixon, Khaled & Nacke, 2011, p. 14). Points represent a tangible metric for progress throughout the experience, whether earned through successful interactions, a collection of items, or experiences with others. The leaderboard is a primary feature for gamified apps as it permits players to clearly identify their status among friends, teammates, and other peer groups (Zichermann & Cunningham, 2011). Badges showcase the completion of goals, progress through the app, and an opportunity for social interaction by sharing accomplishments with others (Sailer, Hense, Mayr & Mandl, 2017).

Gamification strategies exist throughout a variety of mobile app categories, including workplace performance, language learning, education, social justice, volunteerism, crowdsourcing, social networking, and health and fitness (Sailer, Hense, Mayr & Mandl, 2017). Health and fitness apps rely on motivation and persuasion to encourage users to adopt healthy eating habits, engage in physical fitness activities, or monitor nutrition and food intake (Lister, West, Cannon, Sax & Brodegard, 2014). For student-athletes, who juggle the demands of academics, practice and training regiments, competition schedules, and potentially limited access to healthy foods and meal preparation spaces, these apps are of high importance (Zuniga,

Downey, McCluskey & Rivers, 2017). However, diet and exercise are complex behaviors that are not easily altered or sustained, and while the purpose and intent of these apps are desired, a successful implementation and user adoption are not always guaranteed (Lister, West, Cannon, Sax & Brodegard, 2014).

Typically, gamified apps motivate users through virtual or physical rewards, like points, leaderboards, and badges. They persuade users to participate through social comparison and the status of other users' performances in the app. Together, these two strategies are believed to foster the desired behaviors in users (Zuckerman & Gal-Oz, 2013). Competition is an intrinsic motivation for many student-athletes to gravitate toward gamified apps (Zuniga, Downey, McCluskey & Rivers, 2017). Other motivations include how personality, the use of technology, and social interactions connect with each other and how they may lead to increased participation. There is an inherent "fear of missing out" when it comes to social media and awareness of peer activities (Whitaker, Chorley & Allen, 2015).

Users interact with and respond to gamification in different ways through the perceived value of gamified elements, methods, and implementation of the app (Zuckerman & Gal-Oz, 2014). For example, certain users react positively to leaderboards as a measure of their performance and strive for the top spot. This type of reward is known as "destructive competition" because there is only one winner. Others react negatively or dismiss the leaderboard, most notably for those who are not within range of the top competitors. This creates a sense of defeat and the belief they are too far behind the leaders to catch up. Research recommends a transformation of the leaderboard into a "constructive competition" through specific challenges and opportunities for those in the middle or bottom of the pack (Goodwin & Ramjaun, 2017, p. 185). A lack of industry standards for gamified elements, compelling

narratives to guide users through a sustained use of the app, and tangible outcomes related to engagement, along with a misguided understanding of the personal value of rewards and social status, and the sustainability of the rewards to change behaviors are often cited by critics of gamification (Deterding, 2012; Lister, West, Cannon, Sax & Brodegard, 2014). Badges and leaderboards alone are not sufficient to create a thoughtful, innovative, and long-lasting engagement opportunity (Deterding, 2012).

### **State-of-the-art nutrition support available to student-athletes**

To capitalize on the ubiquity of mobile devices, institutions have connected with app developers to provide health and nutrition resources for their student-athletes. “Fueling Bruins,” from the University of California, Los Angeles was briefly available for student-athletes to review food recommendations for dining in and out, weekly menus, and favorite recipes (a search of the Apple App Store indicates this app was removed and the app was not released for Android devices) (Gottlieb, 2017). “Tiger Nutrition,” developed at Auburn University, was last updated two years ago and provides student-athletes a map of restaurants in each of the conference cities for road games with recommendations for restaurants that include Hardee's, Burger King, and other local options. The app also includes static infographics for the proper components of a balanced meal and nutritional information from the all-you-can-eat dining facility for student-athletes (Macias, 2015). A similar app – “Jayhawks Fuel” – for student-athletes at the University of Kansas includes a cookbook, restaurant menu recommendations, nutrition staff directory listing, and nutrition guides (“Jayhawk Fuel App”, 2015).

Student-athletes also incorporate apps from the consumer market into their training, practice, and competition routines, which is flooded with nutrition- and diet-centric apps like MyFitnessPal, RunKeeper, Google Fit, and Apple Health. Although apps like MyFitnessPal and

RunKeeper appeal to fitness-minded individuals, they do not specifically address the unique needs of student-athletes. For example, MyFitnessPal offers a food database with more than 11 million items that includes ingredients, calorie count, and serving size. Users can also track meals and log fitness activities (“Fitness starts with what you eat,” 2019). However, studies have shown that student-athletes are most interested in how to plan a healthy meal or snack with the proper balance of fat, protein, carbohydrates, and fiber. “Protein needs, performance hydration, fueling during exercise, nutrition for injuries, and healthy food choices at restaurants” (Zuniga, Downey, McCluskey, & Rivers, 2017, p. 45) outweigh the ability to log meals or track activity.

In addition to mobile apps, athletic departments have pursued other opportunities to provide student-athletes with the necessary information, support, and education to ensure peak performance. At Baylor University, a \$100,000 dual-energy X-ray absorptiometry machine is used to analyze physical progress through the measurement of bone, muscle, and fat mass. Twice a year, student-athletes are scanned, and the staff reviews the results along with urine samples and other medical tests. Sports dieticians at Purdue University connected with the agriculture program and a horticulture professor to transform a 75-foot by 25-foot section of grounds by the football practice field into a student-athlete community garden. They are able to tend to the garden and take produce like kale, tomatoes, zucchini, onions, peppers, squash, and herbs. Through a collaboration with strength and conditioning coaches and the nutrition and food sciences program at California Baptist University, they developed a nutrition guide that serves as the basis for a 1-credit-hour course and a directory of healthy food options at dining halls on campus (Stark, 2015).

Due to the potential of misinformation from social media, family, friends, trainers, and coaches, researchers have created curriculum frameworks for student-athlete nutrition education

programs (Karpinski, 2012; Parks, et al., 2016). Too often, the academy and athletic departments are divided and do not take advantage of the resources and opportunities available; athletic departments are unaware of the education programs available on campus and the academy assumes the necessary resources are in place (Karpinski, 2012). Curriculum recommendations include a focus on personal nutrition through a survey of existing nutrition behaviors, perceived education needs, and available academic and faculty resources (Parks, et al., 2016); a target audience of freshman so knowledge can follow them throughout their athletic career (Karpinski, 2012); and learning opportunities like food comparison and grocery shopping strategies, cooking lessons, and basic recipes for high-value nutrition gains (Parks, et al., 2016).

The methods in the following chapter seek to test the usability of BSUathLEATS and uncover and understand the motivating factors that drive user engagement.

### **Chapter 3: Methodology**

This thesis employed a mixed-methods approach as part of two usability studies with Ball State University student athletes. Study 1 used a moderated usability test and semi-structured interviews to collect feedback from the athletes based on the mostly-functional version of BSUathLEATS installed on a test device. Study 2 was a two-week beta test that included a diary study, two surveys, semi-structured interviews, follow-up moderated usability test, and mobile analytics to collect feedback, data, and metrics through real-world situations with a variety of athletes and devices.

#### **Study 1: Usability**

A moderated usability test and semi-structured interviews were used to understand how first-time users might interact with and experience the features, functionality, layout, and design of BSUathLEATS. As part of the usability study, three instruments were used to collect data and feedback based on the current iteration of BSUathLEATS. First, 10 task scenarios guided participants through a typical interaction with the app, including functional, social, and gameplay aspects. Ten participants met one-on-one with the researcher and used the same Android-based mobile device – the Google Pixel 2 XL – to complete the tasks. Since all participants used an iPhone as their personal device, they were shown how to use the Android phone to minimize user experience issues with the device as opposed to the app. Participants were asked to think aloud while exploring the app to narrate their thought processes, expectations, insights, and other feedback relative to the task. The Nielsen Norman Group refers to the Think-Aloud protocol as a “window on the soul,” offering the ability to uncover misconceptions, initial impressions, and perceived struggles or surprises with the focus of the usability test (Nielsen, 2012).

After each task, participants completed a Task Difficulty Rating to identify the perceived ease or complexity of the task and offer any additional comments. The Task Difficulty Rating is considered a “single ease question” and offers a way to capture a subjective view of the app’s current state and is used as a comparison tool for future iterations. Participants were asked to articulate why they selected the rating for each task, as the rating itself does not provide insight as to what caused them to struggle or how to resolve the issue (Laubheimer, 2018).

After participants completed the 10 task scenarios, they completed the System Usability Scale, a “quick and dirty usability scale” (Brooke, 1996), a 10-item questionnaire used to determine the overall usability of the mobile app based on common industry standards. Created before modern graphical user interfaces, the System Usability Scale continues to offer developers and researchers a benchmark based on decades of data collected from multiple industries on a wide range of devices and form factors (Laubheimer, 2018).

After the task scenarios and quantitative data collection, a semi-structured interview was used to further explore responses provided during the session. The interview consisted of five questions and additional discussions based on the responses. This provided the researcher an opportunity to understand potential motivating factors for user engagement, pain points and areas of lostness, and recommendations for additional improvements. Screen and audio recording software captured the device interactions, comments made using the Think-Aloud protocol, and conversations during the interview.

### *Participants*

Ten Ball State University student athletes were recruited by the strength and conditioning coach in the Athletics department to participate in Study 1. The group included four male athletes and six female athletes from eight different sports, including women’s swimming and

diving, golf, gymnastics, softball, and field hockey and men's golf, volleyball, and swimming and diving. The participants had prior knowledge of health and nutrition strategies, fitness apps for mobile devices, current services offered to Ball State athletes, and the overall goals and purpose of BSUathlEATS.

### *Analysis*

Analysis of the data and comments collected from the Task Difficulty Rating, System Usability Scale, and the semi-structured interviews produced a list of recommendations for improvement and modifications to BSUathlEATS. Each item was assigned to a category based on whether the suggested change related to features, functionality, layout, or design. Some responses received a positive or negative assignment if they evaluated the pros and cons of design or implementation decisions. For example, the pros and cons of using an average of the register players' scores during a competition round to ensure equity and fairness among teams like women's golf (nine potential players) versus football (100 potential players). Similar items were grouped together using the research questions as a framework. For example, those items related to functional, social, and competitive aspects of BSUathlEATS, with a general category of health and nutrition. The list was then prioritized as development tasks based on the frequency of mentions by the participants, feasibility of the implementation, and adherence to mobile design and development best practices. In addition, the quantitative data from the Task Difficulty Rating and System Usability Scale were calculated and averaged per task and/or participant.

### **Study 2: Beta test**

A two-week beta test, diary study, two surveys, semi-structured interviews, and mobile analytics and crash reports were used to collect feedback, data, and metrics through real-world situations and everyday use of BSUathlEATS. Fifteen student-athletes participated in a two-



week beta test to use BSUathlEATS as part of their daily routine. With the exception of one person, each of the 15 student-athletes met with the researcher prior to the start of the beta test for a face-to-face introduction. At that meeting, the researcher outlined the process of the study, determined mobile device compatibility, and emphasized the importance of their participation and adherence to the requirements of the study. Although the registration process is typically part of the initial user experience, each participant was automatically registered for the first round of competition within the app.

In addition, the participants were given a high-level overview of the project and how it began with the EMDD graduate program in 2017. No further details regarding the app or functionality were provided in order to collect accurate and unbiased information during the study. Participants using an iPhone were invited to download BSUathlEATS through TestFlight from Apple's App Store Connect program. This tool allows developers to release a beta version of an app to a limited number of people. The single participant with an Android device received the app during the introductory meeting through a direct install from the researcher's development computer using the Android Debug Bridge. At the conclusion of the introductory meetings, an email was sent to each participant with a link to the daily diary and a reminder about the surveys at the end of the first and second weeks of the study.

The survey used at the end of the first and second weeks of the study was a modified version of the SUPR-Qm, a questionnaire used to measure the mobile app user experience regardless of the type of app (Sauro & Zarolia, 2017). Based on the current features and functionality of BSUathlEATS, the item "The app offers features its mobile website doesn't." was excluded from the survey. BSUathlEATS does not have a corresponding mobile website, nor will it. Four free-form responses were included as part of the 22-item questionnaire and were

used to collect additional feedback from the participants related to how they felt about BSUathlEATS.

At the end of the two-week period, 10 of the 15 participants were invited to a semi-structured interview to discuss topics related to the functionality and design, social, gameplay and motivational, and engagement aspects of BSUathlEATS. Participants were selected based on availability, willingness to participate, and a sample of those who were both highly and minimally engaged throughout the two-week beta test. In addition, metrics were collected throughout the two weeks using Google Analytics for Firebase software development kit (SDK). The SDK allows developers to automatically capture a number of events and user properties from Android and iOS mobile apps (Google Analytics for Firebase, n.d.). Data related to screen usage, content viewed, crashes, and frequency of engagement were collected for analysis and review. Metrics related to the content viewed included items like comments and shares from the social feed, challenges and point quests completed, and the number of participants who viewed the onboarding screens or read the rules. Crash data provided the developers detailed information on problems the participants encountered with the necessary technical details to further investigate the issue.

### *Participants*

Sixteen Ball State University student athletes were recruited by the strength and conditioning coach in the Athletics department to participate in Study 2. An additional athlete joined the study at the invitation of one of the original recruits, bringing the total to 17 participants. At the conclusion of the study, two participants were eliminated due to lack of interaction with the app, failure to submit the daily diary entries and surveys, and unresponsiveness to email communications. The group included three male athletes from the

swimming and diving team, five female athletes from field hockey, three female athletes from volleyball, and four female athletes from soccer. Fourteen athletes used an Apple iPhone and one used an Android device. The participants had prior knowledge of health and nutrition strategies, fitness apps for mobile devices, current services offered to Ball State athletes, and the overall goals and purpose of BSUathlEATS.

### *Analysis*

Responses from 103 daily diary entries, 30 survey submissions, and 11 semi-structured interviews were recorded, organized, and coded based on whether they related to features, functionality, layout, or design. Depending on the question from the daily diary, certain responses were not counted. For example, if the participant indicated he or she did not use the app, if the response was unclear, or if a response was not provided. When participants were asked whether they used the app for a specific day, the response of “did not use” was recorded and counted. For the survey administered the second week of the study, participants were asked to explain whether their responses changed from the first week. Responses to that question received a positive, negative, or no change assignment. For each method, similar responses were grouped together using the research questions as a framework. For example, those items related to functional, social, and competitive aspects of BSUathlEATS, with a general category of health and nutrition. A composite list was then generated and prioritized as future development tasks based on the frequency of mentions by the participants, feasibility of the implementation, and adherence to mobile design and development best practices.

Metrics and other data collected from participant usage were also analyzed and reviewed. Challenges and point quests completed by the participants were grouped by day and item. This data helped inform the semi-structured interviews at the end of the two-week beta test. For

example, a noticeable decline was observed in the number of challenges completed between week one and two. These observances were incorporated into the semi-structured interviews to better understand participant reactions and engagement during the beta test. The metrics collected by the Google Analytics for Firebase SDK were downloaded from the Firebase Developer Console (<https://console.firebase.google.com>) and exported to a spreadsheet for review and analysis. Data was organized by the day of activity, content viewed by the participants, and screens viewed.

The following chapter reports on the results obtained through the various facets the two studies. Study 1 includes task-based inspection, Task Difficulty Rating, System Usability Scale, and semi-structured interviews. Study 2 includes a beta test, diary study, surveys, semi-structured interviews, and mobile analytics and crash data.

## Chapter 4: Results

### Study 1: Usability

Ten student-athletes participated in a moderated usability study and a semi-structured interview for a pre-beta version of the mobile app BSUathLEATS. Each participant met one-on-one with the researcher and used the same Android-based mobile device - the Google Pixel 2 XL - to complete 10 task scenarios and answer a series of follow-up questions.

#### *Demographics*

Of the 10 participants, more than half were female (n=6) and were from women's swimming and diving (n=2), softball (n=1), gymnastics (n=1), golf (n=1), and field hockey (n=1). The remainder of the participants (n=4) were male and from men's swimming and diving (n=2), golf (n=1), and volleyball (n=1). More than half (n=6) were seniors, and the remainder were juniors (n=2), sophomores (n=1), and freshmen (n=1).

#### *Task-based inspection*

Participants were asked to use the Think-Aloud protocol for the following 10 task scenarios:

1. You just downloaded BSUathLEATS from the app store. Now register for the upcoming challenge round.
2. Check out the posts from your teammates and engage with them.
3. Find how to participate and compete in the competition rounds.
4. The competition has started and your teammates are counting on you to earn points, so complete a challenge.
5. Find other ways you can earn points during the competition round and complete one of your choosing.

6. Check out the matchups for this round. What is the current point standing for your team?
7. What team do you play in Round 3?
8. Find your current position on the leaderboard. What place are you in and how are you doing in the rankings?
9. Find the badges you've earned. Which badges haven't you earned yet?
10. The current round is almost over, so don't forget to register for round 2.

A total of 144 comments were recorded and coded, resulting in 26 main concepts. This data was further analyzed and grouped into four themes (Table 1):

<i>Themes</i>	<i>Percentage Occurrence</i>	<i>Number of Statements</i>
<b>COMPETITION:</b> Gameplay and competition elements to connect with student-athletes.	<b>46.53</b>	<b>67</b>
<b>FUNCTIONALITY/DESIGN:</b> User-centered design principles and overall functionality.	<b>34.03</b>	<b>49</b>
<b>SOCIAL:</b> Social networking concepts to facilitate connections and engagement.	<b>17.36</b>	<b>25</b>
<b>NUTRITION:</b> Ideas and inspiration to eat healthy.	<b>2.08</b>	<b>3</b>

**Table 1.** Four themes emerged from the comments made using the Think Aloud protocol during task-based inspection.

The majority of comments (n=67) made during the task-based inspection related to the competition aspects of the app. Ten main concepts emerged from the comments and included: *Leaderboard: recommended improvements, overall impression, and mixed user experience* (n=21); *Matchups: recommended improvements* (n=12); and *Challenges: judging criteria, frequency of completion, and submission process* (n=9). Forty-nine comments related to functionality and design included: *Rules: visibility and recommended content* (n=16);

*Registration: what it means and recommended improvements (n=11); and Navigation: positive user experience (n=5).* Twenty-five comments related to social aspects included: *Posts: recommended improvements and mixed user experience (n=12) and Profile: recommended improvements and mixed user experience (n=6).*

*Theme One: Competition (n=67)*

Participants liked the Leaderboard and offered feedback to clarify the content displayed (n=21). Participant 8, a male athlete from swimming and diving, stated the leaderboard was a source of motivation and encouraged him to participate in the Challenges and Point Quests to claim the top spot. However, participants consistently noted that the design of the screen was the confusing (n=11). Although, the intent was to use color to identify whether athletes moved up or down in the rankings, b participants did not immediately understand this and recommended the use of a “+/-” or “up and down” arrow identifiers to convey the intended objective. The Matchups screen generated several recommendations for improvement as well, primarily focused on the ability to register for upcoming competition rounds directly from the Matchups screen (n=4). Participant 7, a male athlete from swimming and diving, enjoyed the opportunity to compete against other teams and wanted the option to request a specific opponent for a “battle round.” Participant 1 stated the incentive to use the app relied on other teammates and athletes to register and compete in the challenges.

*Theme Two: Functionality/Design (n=49)*

Participants offered recommendations for improvement (n=37) for the rules and how to compete. Sixteen responses indicated the “Rules” menu option was not immediately visible and should capture the attention of users when they first launch the app through an onboarding process, require acceptance of the rules before proceeding, or display a call-to-action event to

emphasize the rules menu option. Of those participants who identified the rules as an area of improvement (n=16), the majority (n=7) struggled to find the menu option on the top navigation bar, as their eyes were drawn to the center of the screen and they were more interested in self-exploration [P4 & P7]. Participants also identified a general lack of understanding related to the gameplay and overall structure of the competition. Although participants were able to successfully register, they either did not understand the reason for the registration [P1] or they wanted the option to appear on multiple screens throughout the app [P5, P6, and P10]. Participant 1, 4, 5, and 8 all expressed positive reactions to the design, icons, and layout of BSUathlEATS. It was “clean and simple” [P4] and “nicely displayed” [P8].

#### *Theme Three: Social (n=25)*

Participants also offered recommendations for improvements (n=15) for the posts on the social feed. Like mainstream social media platforms, participants tapped on the photo for the post and expected to view full-screen, uncropped version of the image. However, this functionality was not implemented in the tested version of BSUathlEATS. Other comments (n=7) focused on the user experience and positive comparisons to mainstream social media platforms related to profile photos, along with the “like,” “share,” and “comment” functionality of the posts.

#### *Theme Four: Nutrition (n=3)*

The remainder of the comments (n=3) related to nutrition and focused on positive reactions for meal ideas and recipes.

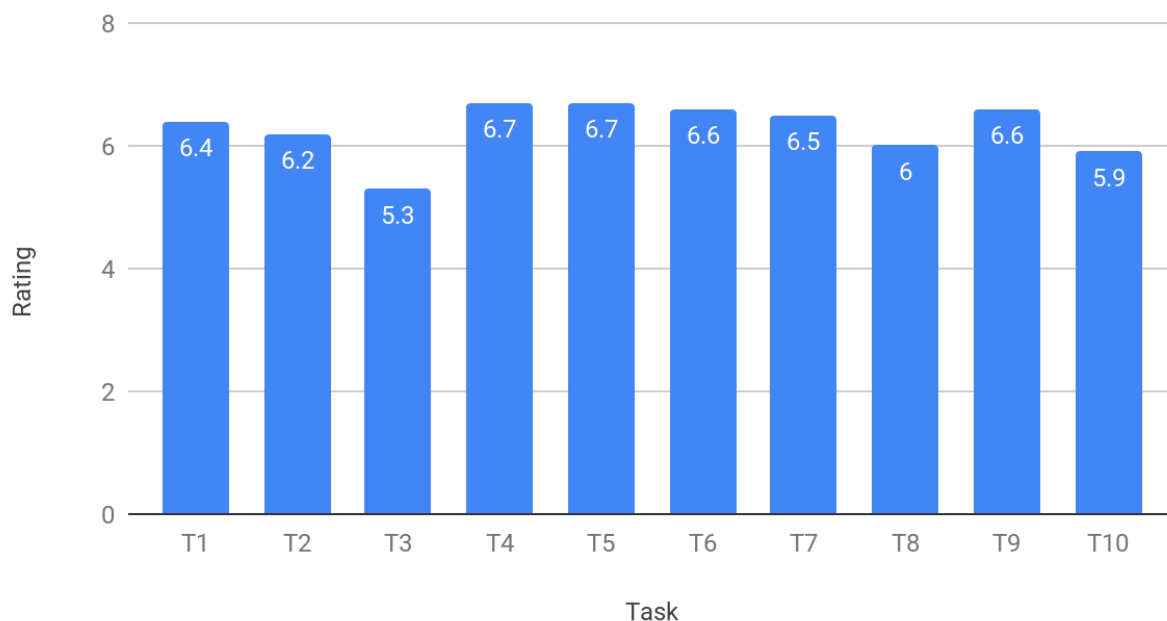
#### *Task Difficulty Rating*

Participants completed the Task Difficulty Rating for each of the 10 tasks during the moderated usability study (Figure 1). According to MeasuringU, the average score for a “Single



Ease Question” like the Task Difficulty Rating is around a 5.5 (Sauro, 2012). With the exception of Task 3 (*Find how to participate and compete in the competition rounds.*) at 5.3 and Task 10 (*The current round is almost over, so don't forget to register for round 2.*) at 5.9, the average score for the remaining eight tasks was above 6.0, with a maximum value of 6.7 for Tasks 4 and 5. Participants stated Task 10 was more difficult due to the placement of the registration menu option. They expected the option to appear either on the Matchups or Challenges screen and did not instinctively tap on the “hamburger icon” to open the side navigation menu where the “Register to compete” menu option appeared.

### Task Difficulty Rating



**Figure 1.** Average task difficulty rating for each of the 10 task scenarios. A rating of 7 indicates the task is “very easy” and 1 indicates “very difficult.”

Participants stated Task 3 (*Find how to participate and compete in the competition rounds.*) and Task 8 (*Find your current position on the leaderboard. What place are you in and how are you doing in the rankings?*) were problematic due to the wording of the tasks. For Task 3, the phrase “Find how...” led participants to the Challenge and Point Quest screen where they

completed an item to earn points. However, the intent of the question was to locate the “Rules” menu option in the top navigation bar and “*learn how*” to participate and compete in the competition rounds. For Task 8, participants easily found their position on the leaderboard, but they did not understand the purpose of the red and green circles on the profile photos and could not identify “how are you doing in the rankings” (n=6).

Six of 10 participants provided 78 additional comments on the rating sheet. Four participants did not provide additional comments, they only rated the task difficulty. Those 78 comments were coded, resulting in 17 main concepts. This data was further synthesized and grouped into three themes (Table 2):

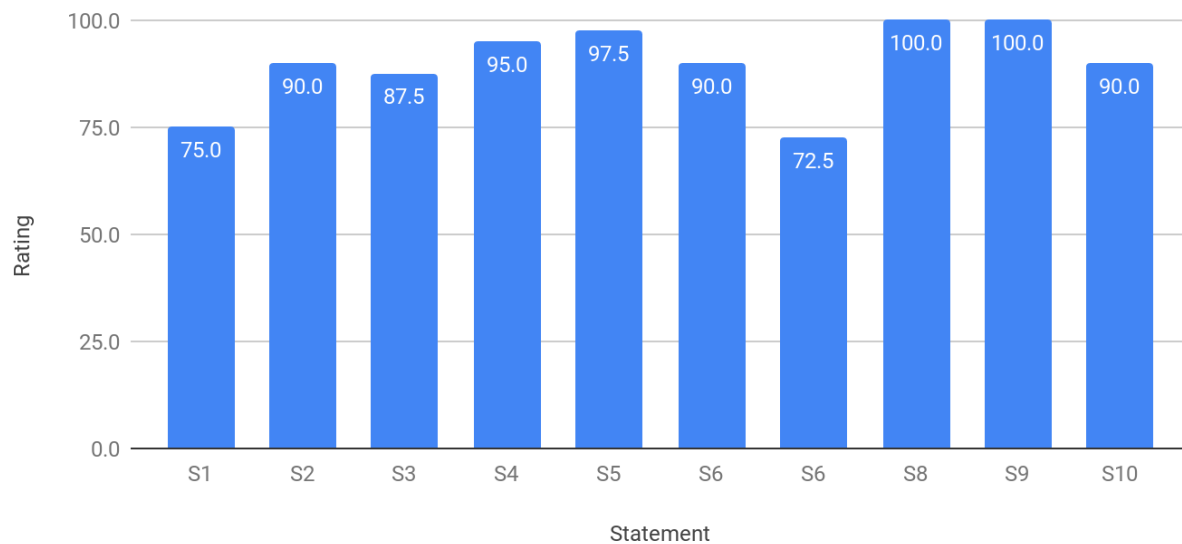
<i>Themes</i>	<i>Percentage Occurrence</i>	<i>Number of Statements</i>
<b>FUNCTIONALITY:</b> User-centered design principles and overall functionality.	<b>42.31</b>	<b>33</b>
<b>COMPETITION:</b> Gameplay and competition elements to connect with student-athletes.	<b>39.74</b>	<b>31</b>
<b>SOCIAL:</b> Social networking concepts to facilitate connections and engagement.	<b>17.95</b>	<b>14</b>

**Table 2.** Three themes emerged from the comments from the Task Difficulty Rating sheet.

### *System Usability Scale*

At the end of the task scenarios, each participant completed the System Usability Scale (SUS) (Figure 2). Although Sauro indicates “there has been little on guidance on interpreting SUS scores” (2011, “Interpreting SUS Scores,” para. 1), his research and over 500 usability elevations identified a score of 68 as average. Systems with a score above 80.3 earn an “A” and users are more likely to offer positive recommendations to others (Sauro, 2011). Based on feedback from the participants of this study, the average SUS score for BSUathLEATS is 89.75, which earned the “A” rating.

### System Usability Scale Ratings



**Figure 2.** Average System Usability Scale ratings for each of the 10 statements from the 10 participants.

Eight of 10 participants provided 26 additional comments on the rating sheet. Two participants did not provide additional comments, they only rated the SUS. Those 26 comments were coded, resulting in 13 main concepts. This data was further synthesized and group into three themes (Table 3):

<i>Themes</i>	<i>Percentage Occurrence</i>	<i>Number of Statements</i>
<b>FUNCTIONALITY/DESIGN:</b> User-centered design principles and overall functionality.	<b>61.53</b>	<b>16</b>
<b>COMPETITION:</b> Gameplay and competition elements to connect with student-athletes.	<b>30.77</b>	<b>8</b>
<b>SOCIAL:</b> Social networking concepts to facilitate connections and engagement.	<b>7.69</b>	<b>2</b>

**Table 3.** Three themes emerged from comments from the System Usability Scale sheet.

Under the theme of *Functionality/Design* (n=16), the majority of the comments (n=10) offered positive feedback for the layout, iconography, and navigation. Three comments for

*Onboarding for First-Time Users: Missed opportunities to ground experience and*

*Overwhelming: Recommendations for improvement* indicated potential problems with the overall functionality of the system. However, participants responded with perfect ratings on the SUS for Statements 8 (*I found the system very cumbersome to use.*) and 9 (*I felt very confident using the system.*). Under the theme of *Competition* (n=8), participants responded positively to future use of the app (*Engagement: Excited for future, n=4*) and three participants thought the Leaderboard (n=3) and Matchups (n=2) would encourage competition among athletes. However, Statement 1 (*I think that I would like to use this system frequently.*) on the SUS earned the second lowest scores among the 10 participants with an average of 75.0.

### *Semi-structured interview*

At the end of the moderated user test, each participant responded to a series of five questions related to the process of onboarding and how new users are introduced to the features and functionality of the app; the structure of gameplay elements like registration and points; mobile device notifications, along with timing and content; and overall interest and willingness to participate in a semester-long competition. Of the 26 comments related to the onboarding process, the majority (n=15) requested a clear explanation of the gameplay mechanics, rules, and how to engage with the app. Participants were asked to identify pros and cons of requiring app users to register for the competition prior to the start of each bi-weekly round (n=23). The majority of comments (n=14) provided a positive response to this requirement and stated that it would encourage accountability (n=4) and motivation to compete (n=3). The negative comments identified the potential to exclude athletes (n=3) and the possibility they would abandon the app (n=3). When asked about points, participants provided 22 comments that focused on a clear explanation of the rules and how points were awarded (n=7). They offered a positive perspective

on the structure and fairness of awarding team points based on an average of registered users and total points scored (n=8). Notifications were viewed as an important aspect of the competition (n=10) based on 14 comments. Participants wanted weekly score updates (n=5), registration reminders the day before a new competition round (n=4), and feedback on the completion of challenges (n=1). Finally, contrary to the responses for Statement 1 on the SUS, all participants (n=10) responded positively to future use of the app and some requested the option of an off-week during playoff/championship weeks for their respective sports (n=3).

Based on the results from Study 1, revisions were made to BSUathlEATS in preparation for the two-week beta test and related activities for Study 2.

## **Study 2: Beta test**

Study 2 included 15 athletes who participated in a two-week beta test and diary study and completed two surveys. Ten of 15 participated in a semi-structured interview. Mobile analytics and crash reports were automatically captured by the app to collect metrics and data through real-world situations and everyday use of BSUathlEATS.

### *Demographics*

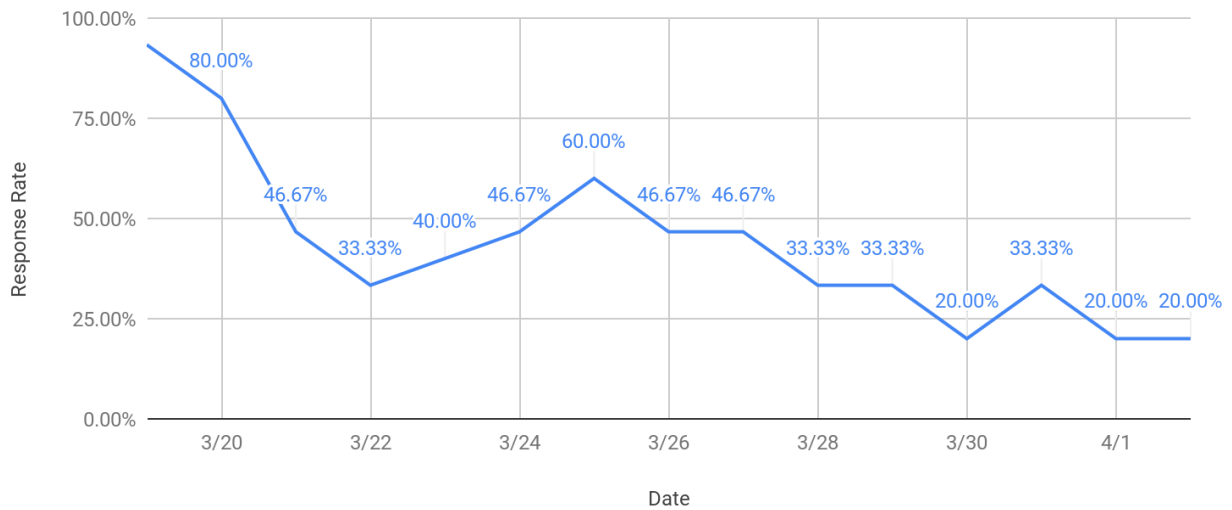
The majority of the participants were female (n=12) and were from field hockey (n=5), soccer (n=4), and volleyball (n=3). The remainder of the participants (n=3) were male and from swimming and diving. More than half (n=8) were sophomores, and the remainder were seniors (n=1), juniors (n=4), and freshmen (n=2). The majority of participants used an iPhone (n=14) and one participant used an Android device.

### *Diary Study*

Participants were asked to submit a diary entry each day of the two-week study. Submissions were tabulated and recorded (Figure 3). The average response rate was 44 percent

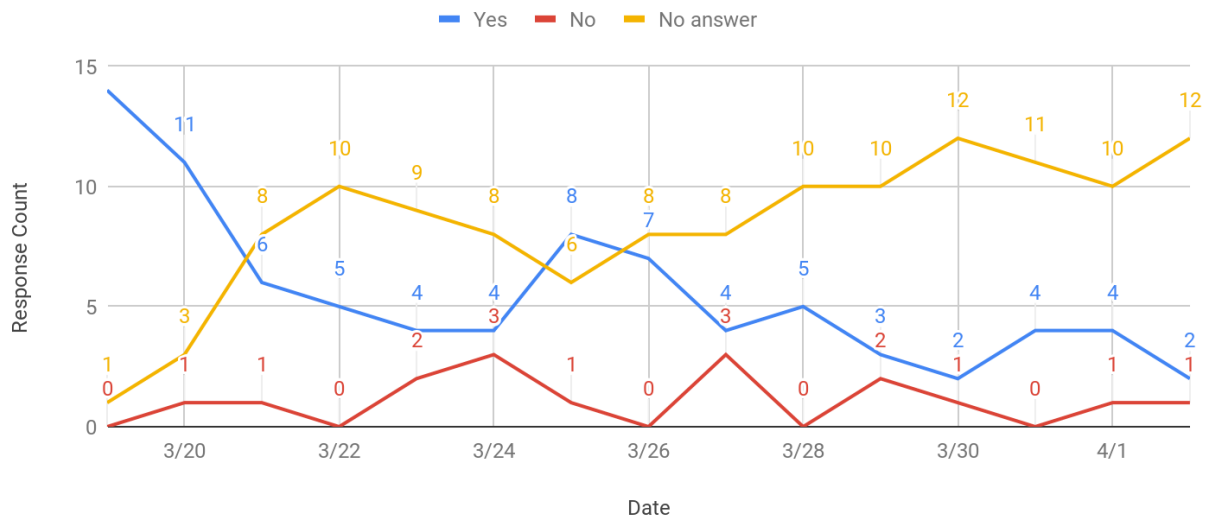
per day. Responses to the multiple-choice question *Did you use the app today?* were tabulated and recorded (Figure 4). On average, 36.89 percent of the participants used the app each day of the study, while 56 percent did not respond, and the remaining 7.11 percent responded that they did not use the app.

Response rate for daily diary entries



**Figure 3.** Daily response rate for the diary study. On March 25, 2019, a reminder was sent via email for all participants to complete the first survey and to maintain the daily diary submissions. The response rate increased to 60 percent on that day and then declined until the conclusion of the study.

### Daily app usage



**Figure 4.** Daily app usage as reported by the diary entries. Responses labeled “Yes” (blue line) indicated active usage for the day, “No” (red line) indicated no usage for the day based on a variety of reasons, and “No answer” (yellow line) indicated the participant did not submit an entry that day.

Participants responded to five free-form responses that asked about their experience with the app. The responses to each question were coded and organized into main concepts. This data was further synthesized and grouped into themes. A total of 253 responses were analyzed. Five main themes emerged from the analysis (Table 4). Twenty-six “no answer” and “nothing” responses were excluded from the themes.

<i>Themes</i>	<i>Percentage Occurrence</i>	<i>Number of statements</i>
<b>COMPETITION:</b> Game play and competition elements to connect with student-athletes	<b>38.7</b>	<b>98</b>
<b>FUNCTIONALITY/DESIGN:</b> User-centered design principles and overall functionality	<b>20.9</b>	<b>53</b>
<b>SOCIAL:</b> Social networking concepts to facilitate connections and engagement	<b>18.6</b>	<b>47</b>
<b>NUTRITION:</b> Ideas and inspiration to eat healthy	<b>5.9</b>	<b>15</b>

<b>DID NOT USE:</b> Reasons the participant was unable to use the app	<b>5.5</b>	<b>14</b>
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**Table 4.** Five themes emerged from responses from the free-form questions on the daily diary entries.

The majority of the comments (n=98) submitted for the daily diary entries related to the competition aspects of the app. Five main concepts emerged from the comments and included: *Points: check points, complete a challenge, and earn points for team* (n=40); *Challenges: recommended improvements, stale content, engagement, participation, difficult combination, and lack of opportunity to earn points* (n=24); and *Matchups: check team matchups and current score* (n=21). Fifty-three comments related to functionality and design included: *Overall user experience: easy to navigate and enjoyable* (n=24); *Exploration: learn how to use the app* (n=10); and *Problems: crash reports and dead ends in expected navigation* (n=9). Forty-seven comments related to social aspects included: *Feed: check for new posts, recommended improvements, and mixed user experience* (n=41).

*Theme One: Competition (n=98)*

The theme included statements about the overall user experience regarding the Leaderboard, Matchups, and Challenges, along with statements like “I enjoy how we are competing against other teams and how we can see the points.” Overall, participants were interested in how they could earn points (n=61) to help their respective teams compete in the weekly matchups. Participants also offered recommendations for improvements, specifically related to the combination of challenges during the second week of competition. Participant 3, a female athlete from field hockey, stated “I think this combo of challenges is a little difficult to complete since we’re not in season, the grocery is like a once every two weeks thing for me, and I have no fruit costumes. I like the idea of these challenges, they’re just difficult when it’s them



in combination.” Three participants wanted more variety and more frequent updates to the challenges available [P7, P1 & P14].

*Theme Two: Functionality/Design (n=53)*

The theme included statements about the overall user experience regarding the registration process, onboarding and rules, and the opportunity to explore and learn more about the app. Participant 5 stated “Being the first day, I was pleased with the overall appearance of the app and its functionality as a first-time user.” Participants also offered several recommendations for improvements, including the use of push notifications when the judges reviewed a challenge and awarded points; the ability to view full-screen photos of posts from the social feed; the ability to tag or mention other athletes in posts and comments; and the inclusion of resources and materials from the nutritionist and strength/conditioning coaching staff.

*Theme Three: Social (n=47)*

The theme included statements about the overall user experience and recommendations for improvement. The majority of participants (n=36) checked the social feed for meal ideas and new recipes. Negative comments (n=5) focused on limitations with the social feed. Participant 10, a female athlete from volleyball, stated “I dislike the fact that you can’t see the whole picture of what is posted, and you cannot see the full description.”

*Survey results*

The SUPR-Qm mobile app experience survey was administered at the end of the first and second weeks of the beta test. Participants were asked to submit their responses using 21 five-point Likert scale questions, one seven-point Likert scale question, and four free-form responses. The five-point Likert scale ratings were 1-5 with 1 being strongly disagree and 5 being strongly agree. The seven-point Likert scale ratings for Question 22 were 1-7 with 1 being very unlikely

and 7 being very likely. The researcher inadvertently made a mistake on the second iteration of the survey. The first survey used a seven-point scale for Question 22: “*How likely are you to recommend the app to a friend or teammate?*” However, the second survey used a nine-point scale. For this reason, a proper comparison is not feasible for Question 22. The results of the remaining 21 questions (Table 5) were compared to one another to determine a positive or negative change in various aspects of the user experience as well as the responses to the four free-form questions (Appendix A):

1. Describe what you like most about the app and why.
2. Describe your primary motivation for downloading the app.
3. What features do you frequently use on the app? Please be specific.
4. Under what circumstances do you use the app?

Survey 2 also included an additional question: “*If your responses changed from the first week, please describe why.*” All 15 of the participants responded with two to three days of the survey period.

<i>SUPR-Qm Likert scale survey questions</i>	<i>Survey 1 Percentage Occurrence</i>					<i>Survey 2 Percentage Occurrence</i>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Q1: Its fun using the app	0	0	33.3	<b>40.0</b>	26.7	0	13.3	26.7	<b>40.0</b>	26.7
Q2: I enjoy using the app	0	0	00.0	<b>53.3</b>	26.7	0	13.3	20.0	<b>33.3</b>	<b>33.3</b>
Q3: Using the app makes me happy	0	26.7	<b>33.3</b>	20.0	20.0	0	13.3	<b>53.3</b>	26.7	6.7
Q4: It’s exciting to use the app	0	6.7	33.3	<b>40.0</b>	20.0	0	13.3	33.3	<b>46.7</b>	6.7
Q5: I use the app when I am bored	20.0	<b>26.7</b>	<b>26.7</b>	20.0	6.7	6.7	20.0	26.7	<b>46.7</b>	0

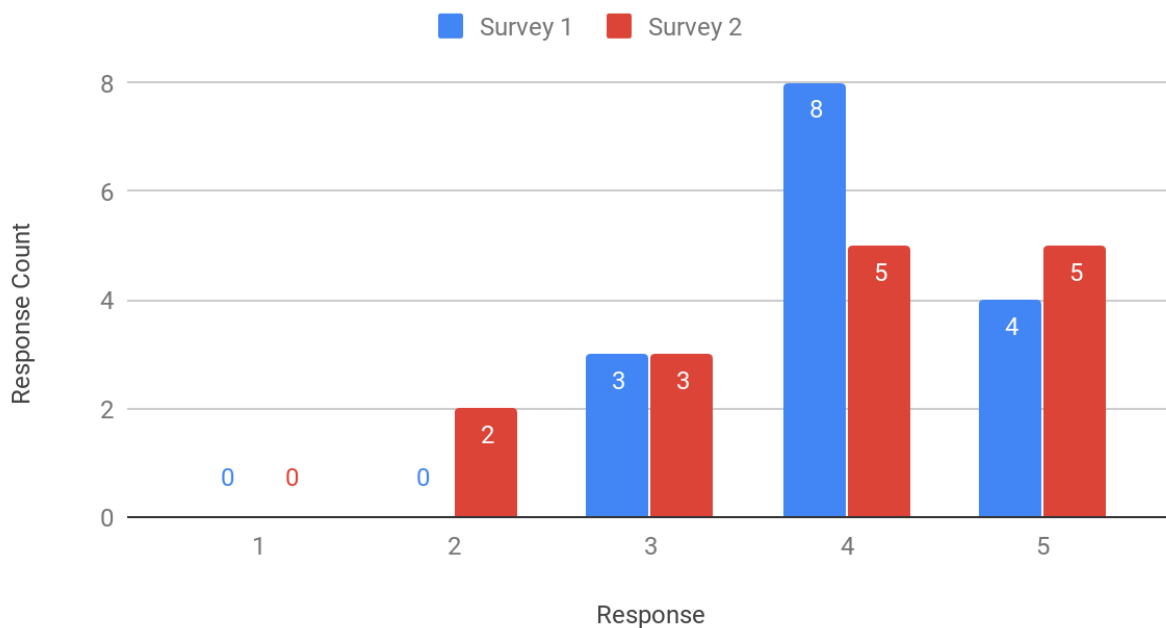
Q6: The app's capabilities meet my requirements	0	6.7	6.7	26.7	<b>53.3</b>	0	0	<b>33.3</b>	<b>33.3</b>	<b>33.3</b>
Q7: The app rarely crashes or causes problems on my phone	6.7	6.7	6.7	26.7	<b>53.3</b>	6.7	13.3	0	26.7	<b>33.3</b>
Q8: The app runs without bugs or errors	6.7	6.7	20.0	<b>33.3</b>	<b>33.3</b>	0	20.0	13.3	20.0	<b>46.7</b>
Q9: I would like to use the app frequently	0	20.0	<b>40.0</b>	33.3	6.7	0	26.7	<b>40.0</b>	33.3	0
Q10: The app does not misuse my personal information	0	0	6.7	13.3	<b>80.0</b>	0	0	0	26.7	<b>73.3</b>
Q11: I trust the app with my personal information	6.7	0	6.7	33.3	<b>53.3</b>	0	0	20.0	20.0	<b>60.0</b>
Q12: I plan to use the app again soon	0	0	26.7	<b>53.3</b>	20.0	0	26.7	20.0	<b>40.0</b>	13.3
Q13: It is easy to navigate within the app	0	0	20.0	26.7	<b>53.3</b>	0	0	0	33.3	<b>53.3</b>
Q14: The app is easy to use	0	0	13.3	26.7	<b>60.0</b>	0	6.7	6.7	26.7	<b>60.0</b>
Q15: I find the app to be attractive	0	0	20.0	<b>40.0</b>	<b>40.0</b>	0	6.7	13.3	<b>40.0</b>	<b>40.0</b>
Q16: The app has a clean and simple presentation	0	0	13.3	33.3	<b>53.3</b>	0	0	0	40.0	<b>60.0</b>
Q17: I like discovering new features on the app	0	0	0	<b>53.3</b>	46.7	0	6.7	13.3	33.3	<b>46.7</b>
Q18: I can't live without the app on my phone	33.3	<b>40.0</b>	20.0	0	0	<b>53.3</b>	40.0	6.7	0	0
Q19: The app is delightful	0	6.7	26.7	<b>53.3</b>	13.3	0	0	33.3	<b>60.0</b>	6.7
Q20: I talk about things I do or learn on the app with my friends	0	20.0	20.0	<b>40.0</b>	20.0	0	20.0	33.3	<b>40.0</b>	6.7

Q21: I am able to connect or communicate with friends directly from the app	6.7	40.0	<b>46.7</b>	6.7	0	0	<b>40.0</b>	33.3	20.0	6.7
Q22: How likely are you to recommend the app to a friend or teammate?	-	-	-	-	-	-	-	-	-	-

**Table 5.** Average responses for the 22 Likert scale questions from the SUPR-Qm mobile app user experience survey administered at the end of the first and second weeks of the study.

Question 2 asked participants whether they enjoyed using the app during the beta test (n=15). For the first survey, the responses were positive with 80 percent (n=12) of participants indicating they *agreed* (n=8) or *strongly agreed* (n=4). Three participants were *neutral*, and no one *disagreed* or *strongly disagreed* with the statement. The positive responses decreased on the second survey, with 67 percent of participants indicating they *agreed* (n=5) or *strongly agreed* (n=5). Neutral responses remained the same (n=3), but two participants *disagreed* with the statement. No one *strongly disagreed* (Figure 5).

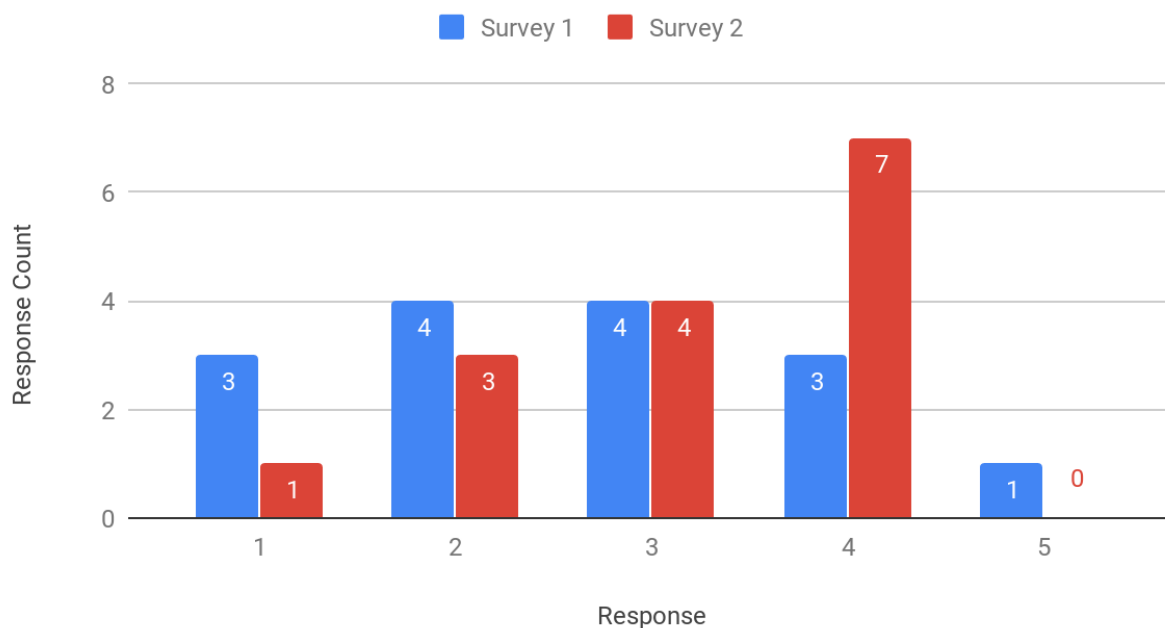
### Q2: I enjoy using the app.



**Figure 5.** Total responses for *Question 2: I enjoy using the app*. The five-point Likert scale ratings were 1-5 with 1 being strongly disagree and 5 being strongly agree.

Question 5 asked participants whether they used the app when they were bored (n=15). For the first survey, the majority of responses were either *neutral* (n=4) or *disagree* (n=4). The remaining responses were *strongly disagree* (n=3), *agree* (n=3), and *strongly agree* (n=1). For the second survey, the majority of participants *agreed* with the statement (n=7) and no one *strongly agreed* (n=0). *Neutral* responses remained the same (n=4), *disagree* decreased by one (n=3), and *strongly disagree* decreased by two (n=1) (Figure 6).

#### Q5: I use the app when I'm bored.

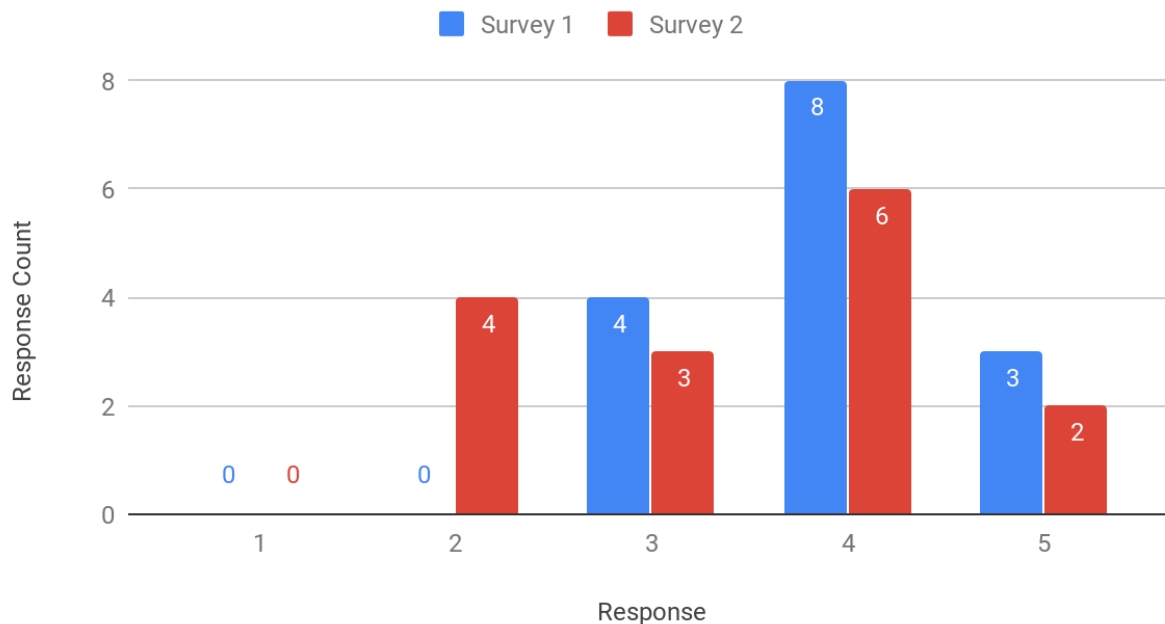


**Figure 6.** Total responses for *Question 5: I use the app when I'm bored*.

Question 12 asked participants whether they plan to use the app again soon (n=15). For the first survey, the responses were positive with 73.3 percent (n=11) of participants indicating they *agreed* (n=8) or *strongly agreed* (n=3). Four participants were *neutral*, and no one *disagreed* or *strongly disagreed* with the statement. The positive responses decreased on the second survey, with 53.3 percent of participants indicating they *agreed* (n=6) or *strongly agreed*

(n=2), while negative responses increased. Four participants indicated they *disagreed* with the statement and neutral responses decreased by one (n=3). No one *strongly disagreed* (Figure 7).

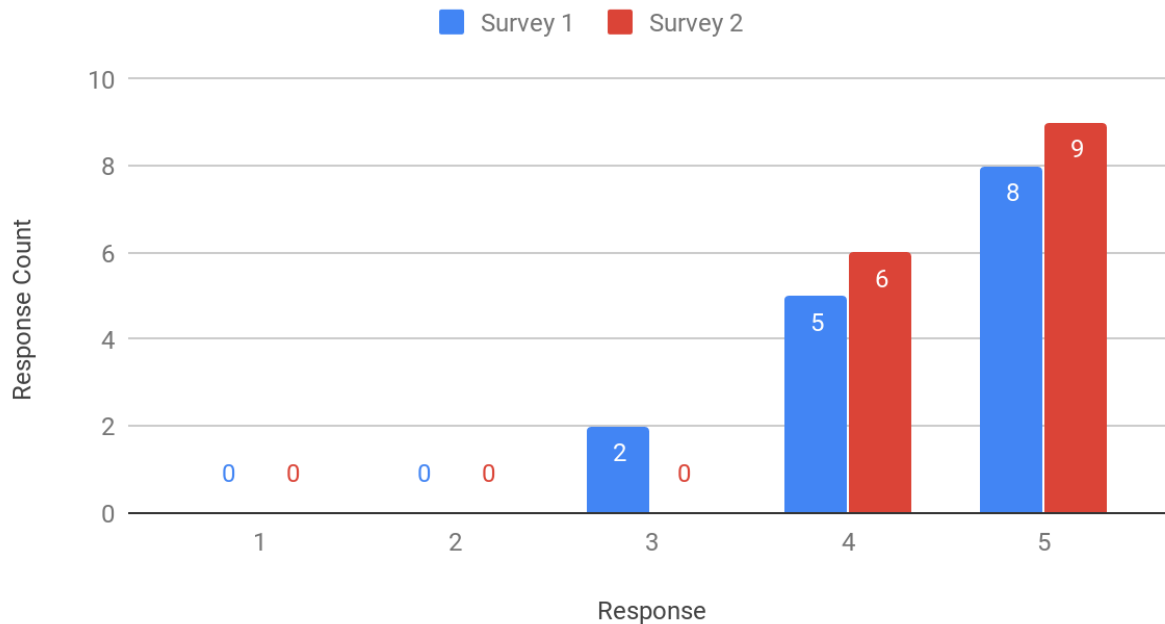
### Q12: I plan to use the app again soon.



**Figure 7.** Total responses for *Question 12: I plan to use the again soon.*

Question 16 asked participants whether they thought the app had a clean and simple presentation (n=15). For the first survey, the responses were positive with 86.7 percent (n=13) of participants indicating they *agreed* (n=5) or *strongly agreed* (n=8). Two participants were *neutral*, and no one *disagreed* or *strongly disagreed* with the statement. The positive responses increased on the second survey, with 100 percent of participants indicating they *agreed* (n=6) or *strongly agreed* (n=9). No one was *neutral*, *disagreed*, or *strongly disagreed* (Figure 8).

### Q16: The app has a clean and simple presentation.



**Figure 8.** Total responses for *Question 16: The app has a clean and simple presentation.*

Participants responded to four free-form responses regarding the most liked aspects of the app, motivation for downloading the app, most used features, and the circumstances in which the app was used. The responses to each question for Survey 1 and Survey 2 were coded and organized into main concepts. This data was further synthesized and grouped into themes.

For the question “*Describe what you like most about the app,*” 22 responses were recorded from the first survey. The majority of participants (n=9) indicated they liked the opportunity to find new recipes and inspiration for meal ideas, as well as compare eating habits. Participant 7, a female athlete from soccer, stated “I like to see what other athletes are eating. It gives me ideas to improve my diet.” Participant 14, a male athlete from swimming and diving, “liked being able to see how my nutrition compares to that other athletes.” Other responses mentioned the competition aspects (n=7), including the challenges and the uniqueness of the app. Participant 12, a female athlete from volleyball, stated “It’s not just a food log. It’s competitive

and almost can serve as social media.” Participants identified both the social feed and overall functionality in three responses each. For the second survey, 24 responses were recorded. The majority of participants (n=8) indicated they liked the competition aspects. However, Participant 13, a male athlete from men’s swimming and diving, stated “I really like the challenges, but some of them are tougher than others and the multiple entries per challenge might make people less interested in being competitive.” The social media features were mentioned six times, while the overall functionality and nutrition aspects were each mentioned five times.

For the question “*What features do you use on the app?*” 25 responses were recorded from the first survey. The majority of responses (n=18) identified the competition aspects of the app as the most-used features, including the Challenges (n=11), Matchups (n=3), and Leaderboard (n=2). Participant 7, a female athlete from volleyball, stated “I upload pictures to get points, I don't know what else there is to do on the app.” Participant 14, a male athlete from men’s swimming and diving, shared a similar perspective: “Playing the ‘games’ to get points but it’s hard to be competitive when the ‘prize’ is theoretically so far in the future. I would probably lose interest after a month or so.” Seven responses were recorded for the social networking aspects. For the second survey, 27 responses were recorded. The majority of responses (n=17) identified the competition aspects of the app as the most used-features, followed by the social networking aspects (n=9), and opportunities to improve their nutrition and eating habits (n=1).

When the participants were asked whether their responses changed from the first week, the majority indicated there was no change (n=8). Six participants indicated their responses were more negative the second week. They forgot to use the app (n=2), were bored of it (n=2), or could not complete the challenges (n=2). Participant 7, a female athlete from soccer, stated “As time went on the activities became repetitive and I had no incentive to continue to go on it. I



eventually forgot about the app.” Participant 6, also from soccer, stated “It kind of gets boring to use the app because the app serves no important purpose.” One participant provided a positive response: “I actually asked one of my teammates to join our team because she thought it was a really cool concept” [P12].

### *Semi-structured interview*

At the end of the two-week beta test, 10 of 15 participants responded to questions focused on an overall assessment of the functionality and design, social, gameplay and motivational, and engagement aspects of BSUathlEATS. A total of 547 comments were recorded and coded, resulting in 35 main concepts. This data was further synthesized and grouped into four themes (Table 6). Of the 547 comments, 177 included more than one theme and created overlap between the different aspects of the app.

<i>Themes</i>	<i>Percentage Occurrence</i>	<i>Number of statements</i>
<b>FUNCTIONALITY:</b> User-centered design principles and overall functionality	<b>47.9</b>	<b>262</b>
<b>COMPETITION:</b> Game play and competition elements to connect with student-athletes	<b>33.82</b>	<b>185</b>
<b>SOCIAL:</b> Social networking concepts to facilitate connections and engagement	<b>12.43</b>	<b>68</b>
<b>NUTRITION:</b> Ideas and inspiration to eat healthy	<b>5.85</b>	<b>32</b>

**Table 6.** Four themes emerged from responses recorded during the semi-structured interviews.

#### *Theme One: Functionality (n=262)*

The functionality theme included statements about recommended improvements (n=86) to several key areas of the app, including the Challenges, Matchups, and Profile. All participants (n=10) requested additional challenges during the competition rounds, as there is the risk of boredom with the same three or four during a two-week period; certain challenges do not align

with schedules; and the combination of challenges can prove difficult to complete, as evident by the sharp decline in participation the second week of the study. For the Matchups, the majority of participants (n=9) responded positively to an option to view matchups for all teams in the competition. Currently, the app only displays the athlete's team and no other teams in the conference or league. BSUathlEATS includes an athlete profile screen that includes frequently updated content, including gallery of social feed posts, badges earned, and point history. The majority of participants (n=8) stated they did not explore the Profile section of the app.

Participant 1, a female athlete from field hockey, stated "It is not necessarily intuitive to see my points on the profile screen." Participant 14, a male athlete from swimming and diving, stated "I do not typically look at profile screens in other apps." Participants recommended the addition of three new menu options on the side navigation - "My Points," "My Gallery," and potentially "My Badges." A majority of participants (n=8) responded negatively to the inclusion of badges in the app. Participant 13, a male athlete from men's swimming and diving, stated "It does not feel like the badges benefit the gameplay - there's no motivation. Unless it contributes to points, there's no benefit."

#### *Theme Two: Competition (n=185)*

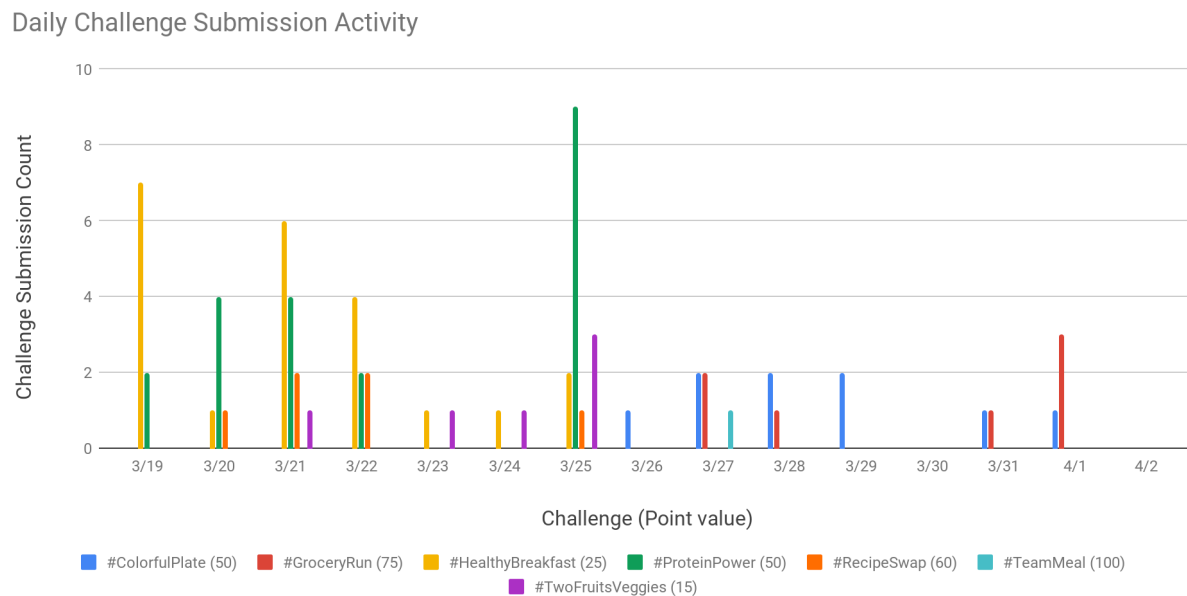
The theme included statements about factors necessary to sustain engagement throughout an entire semester (n=83), features like the Leaderboard (n=20) and Matchups (n=17), and the perceived value of the app's competitive nature (n=14). Although the challenges could coincide with existing activities, participants commented on the demands of their academic and athletic schedules [P3, P4, P6]. Participants identified "team involvement" as a primary motivator to compete, as well as "not feeling like 'another thing' they had to do" [P4]. Participants 1 and 15, a female athlete from soccer and a male athlete from men's swimming and diving, indicated they

would play and would encourage their teammates to get involved. Participant 13, a male athlete men's swimming and diving, stated "Study 2 participants need to be the spokespeople for their teams and we need to have someone on SAAC [Student Athlete Advisory Committee] to help coordinate team efforts." Opinions were mixed regarding the ability to play during season. Half of the participants (n=5) stated they would participate during the season if the challenges aligned with practice and game routines. Participant 10, a female athlete from volleyball, stated "it may be harder to play in season because the team provides meals - our pre-game and travel meals are always the same." Incentives were also identified as a key contributor to engagement. Four participants wanted to win something for competing. Participant 13, a male athlete from men's swimming and diving stated "Food is a better incentive, we get to hang out with our team and celebrate. As long as it's not in the same place we practice in every day."

Participants indicated the Leaderboard was another motivator for the competition [P8, P6 & 14]. Participants 8 and 9, female athletes from soccer, stated it was "important" and Participant 10, a female athlete from volleyball, stated it "was motivating to see what others were doing and how close they got to me, I wanted to keep the first position." Participant 1, a female athlete from field hockey, stated "the Leaderboard provided some motivation, but I wasn't the highest scorer, so I wasn't completely interested." The competitive nature of the app received mixed results from the participant feedback. More than half of the participants (n=6) viewed the competition as a fun distraction and not a resource to help improve their health or nutrition. Participant 6, a female athlete from soccer, stated the "competition aspects didn't matter anymore after the first week" as there "wasn't anything new to experience after you did the app a couple times." She went on to state "People who are participating are already on top of their nutrition and health - the app isn't going to change that."

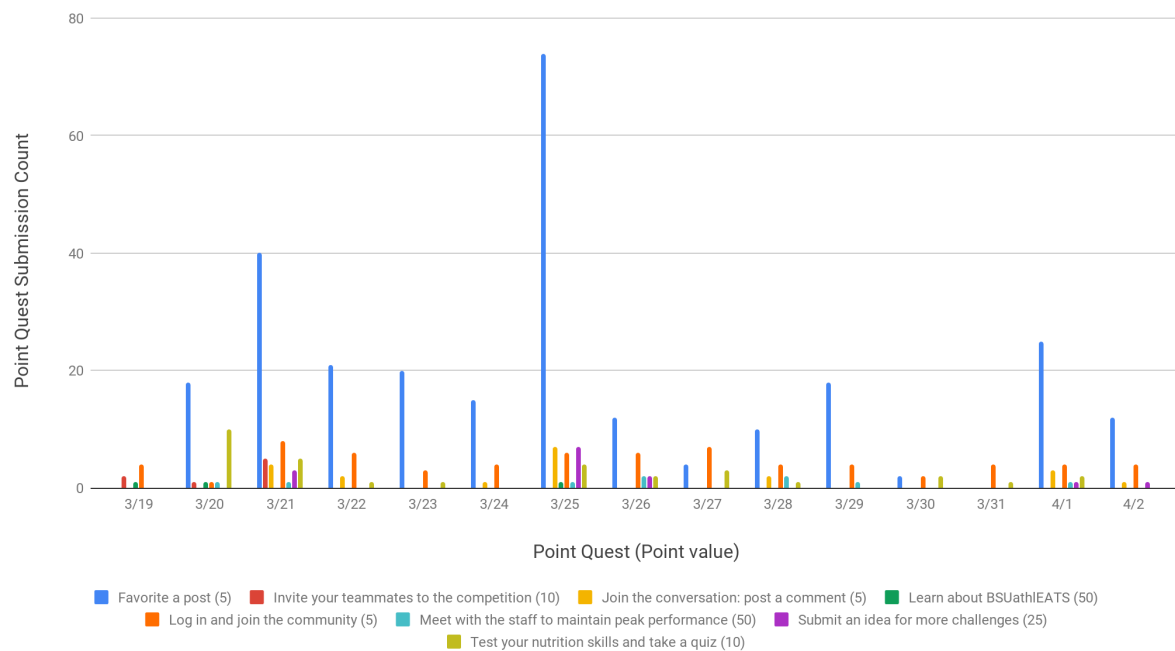
### *Mobile analytics and crash reports*

Mobile analytics and crash reports captured additional data not reported by the participants of the study, including daily Challenge (Figure 9) and Point Quest (Figure 10) submission activity, screen view count per user/per day, and content view count per user/per day. Crash report data from the first day of the study identified a problem with the registration process for iPhone users, which was resolved and an updated version pushed to the participants. Challenge submissions totaled 49 for the first week, compared to 16 for the second week. Point Quest activity also decreased during the second week from 279 submissions to 145.



**Figure 9.** Number of Challenge submissions per each day, including the point value of the Challenge.

Daily Point Quest Submission Activity



**Figure 10.** Number of Point Quest submissions per each day, including the point value of the Point Quest.

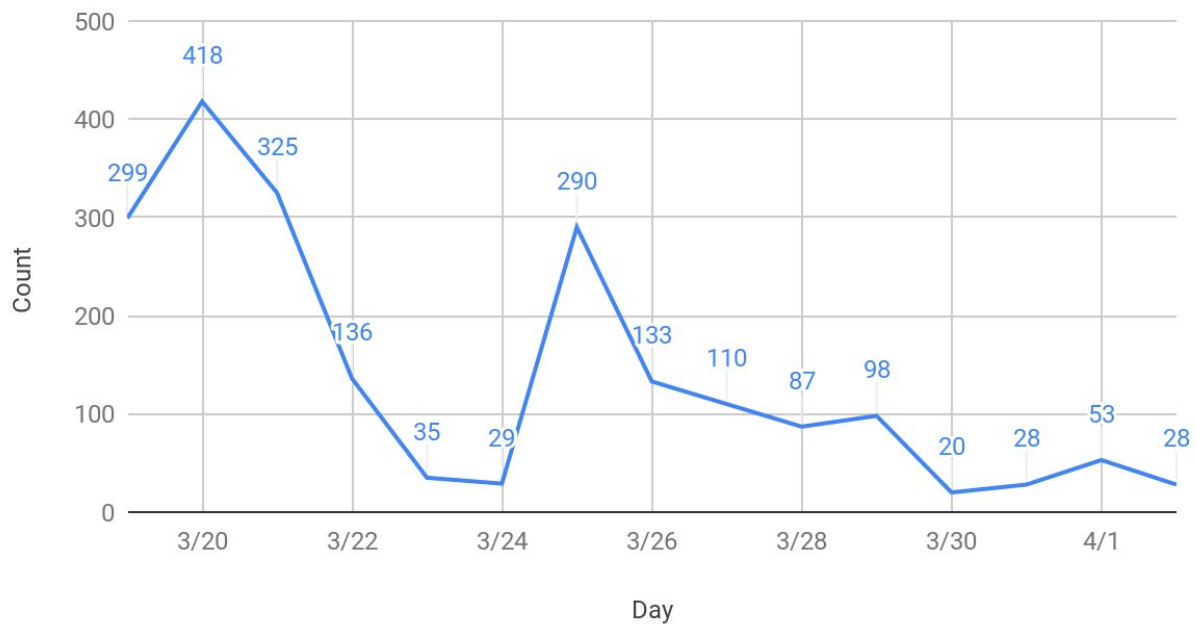
Firestore Analytics provided data on 2,089 screen views for participants with an iPhone (n=14) (Table 7). Figure 11 displays the daily screen views for the iPhone users. Due to a configuration problem for the Android version, screen view counts for the participant (n=1) are not relevant as all screens captured were for the home screen of the app.

<i>Top 10 Mobile app screen views</i>	<i>Percentage Occurrence</i>	<i>Count</i>
<b>Welcome (also the default screen for the app)</b>	<b>16.79</b>	<b>351</b>
<b>Profile</b>	<b>14.58</b>	<b>304</b>
<b>Matchup</b>	<b>11.72</b>	<b>245</b>
<b>Social Feed</b>	<b>10.55</b>	<b>220</b>
<b>Challenges and Point Quests</b>	<b>8.39</b>	<b>175</b>
<b>Onboarding</b>	<b>6.58</b>	<b>138</b>

<b>Leaderboard</b>	<b>5.69</b>	<b>119</b>
<b>Point Quest detail</b>	<b>2.39</b>	<b>50</b>
<b>About the app</b>	<b>2.09</b>	<b>44</b>
<b>Side navigation</b>	<b>1.73</b>	<b>36</b>

**Table 7.** Screen views for iPhone users (2,089).

### Screen views per day (iPhone)



**Figure 11.** Screen views per day for iPhone users.

For all participants (n=15), 369 content views were captured (Table 8). The content views counted the number of times a participant tapped on athlete to view the profile screen, Challenges and Point Quests to view the details and submission instructions, or teams to view the rosters. The majority of content interaction focused on posts from the social feed (n=156), followed by Point Quest details (n=71), and Challenge details (n=53).

<i>Mobile app content views</i>	<i>Percentage Occurrence</i>	<i>Count</i>
<b>Social feed post</b>	<b>42.28</b>	<b>156</b>
<b>Point Quest detail</b>	<b>19.24</b>	<b>71</b>
<b>Challenge detail</b>	<b>14.36</b>	<b>53</b>
<b>Athlete profile from Social feed</b>	<b>8.94</b>	<b>33</b>
<b>Athlete profile from Leaderboard</b>	<b>4.88</b>	<b>18</b>
<b>Athlete profile from Matchups</b>	<b>4.34</b>	<b>16</b>
<b>Register for round</b>	<b>3.52</b>	<b>13</b>
<b>Team standings</b>	<b>1.90</b>	<b>7</b>
<b>Team detail from Matchups</b>	<b>0.27</b>	<b>1</b>
<b>Athlete profile from Team detail</b>	<b>0.27</b>	<b>1</b>

**Table 8.** Mobile app content views for iPhone and Android.

The chapter that follows discusses the findings and explores key concepts that help to understand whether the functionality and design of the app, athletes love for competition, and social networking strategies can drive and encourage user engagement.

## Chapter 5: Discussion

This thesis studied the usability of the mobile app BSUathlEATS, developed for Ball State student-athletes designed to improve nutrition through competition and incentives. Two studies were conducted with 25 student-athletes from nine men's and women's teams. Study 1 evaluated a pre-beta version of the app through task-based inspection, captured quantitative data from the Task Difficulty Rating and System Usability Scale, and gathered additional thoughts and recommendations through semi-structured interviews. Study 2 engaged student-athletes in a two-week beta test to use the app in real-world situations and compete against others, a diary study to understand how and if they used the app, follow-up interviews to further explore the experience, and mobile analytics and crash reports to collect and analyze usage data. This study sought to answer the following research questions: **RQ1:** To what extent do the functional aspects of BSUathlEATS affect users' perceptions of enjoyment, engagement, and usability? **RQ2:** To what extent do the social aspects of BSUathlEATS affect users' perceptions of enjoyment, engagement, and usability? **RQ3:** To what extent do the competitive aspects of BSUathlEATS affect users' perceptions of enjoyment, engagement, and usability? This chapter discusses three key factors related to the functionality and design, one primary consideration related to the social aspects and several recommendations for improvement, and three primary considerations related to the competition aspects. A fourth section offers an important theme related to health and nutrition opportunities to improve the eating habits and performance of Ball State student-athletes.

### Functionality and Design

Regarding RQ1 — To what extent do the functional aspects of BSUathlEATS affect users' perceptions of enjoyment, engagement, and usability? — three factors were identified that



positively and negatively affected perceptions of enjoyment, engagement, and usability: onboarding and a clear understanding of the rules and gameplay mechanics, placement and visibility of key navigation, and frequency and content of notifications. In addition, crash reports were captured from the iPhone version that uncovered problems during the first two days of the study. As hypothesized, the functionality and design aesthetics played a significant role in the user experience.

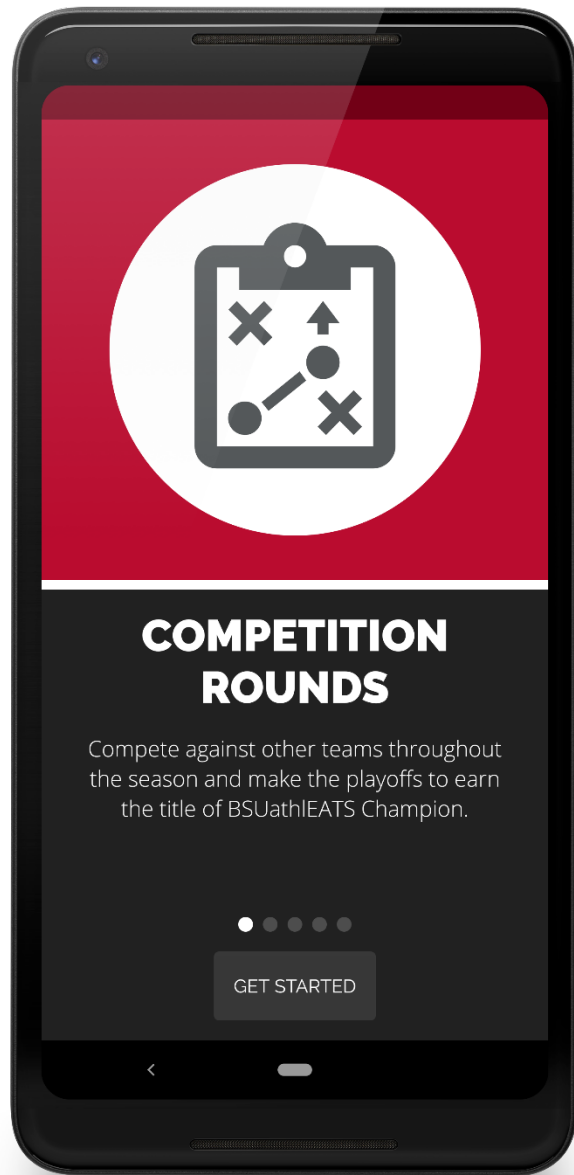
### *Onboarding and gameplay*

A basic understanding of the features, functionality, and layout are critical to the success and widespread adoption of a mobile app. Without this understanding, users may quickly feel frustrated and lost, not fully grasp the purpose and benefits offered, and they will likely uninstall the app. While competition and incentives-based apps may ground the user experience through shared characteristics—social media functionality, fantasy sports elements, and gameplay concepts—with established market leaders or through the use of Android or iPhone design standards, it will typically offer a unique implementation, purpose, and interaction methods. To properly address the unique aspects of the app, onboarding screens are necessary to introduce users to the structure, navigation, and potential benefits they may experience. Presented after an app is installed and before the primary experience, the onboarding screens include iconography and graphics that are consistent with the app design, along with short descriptions that highlight main functionality of the app. Progress indicators, animations, and playful elements encourage users to slide or tap from screen to screen. The layout and navigation should direct users to view each screen before they enter the app (Figure 1). For example, the onboarding screens for BSUathLEATS used progress dots and a bouncing animation at the bottom of the screen, along

with a button to log into the app. However, the button caught users' attention and once tapped, they left the onboarding process. Based on these findings, the navigation should not restrict users from bypassing the introductory screens, but rather limit the ability to skip them.

After users gain a basic understanding of the app features through the onboarding screens, additional content and call-to-action (CTA) buttons can further explain common use-cases or directions to fully interact with and experience the app. For gamified and competition-based apps, this includes an overview of the gameplay mechanics and rules, team or group structures, and details on incentives and rewards for participation. In order to encourage

and direct users to read the content, a one-time CTA and transparent overlay can temporarily restrict the app functionality until they tap, scroll, or interact with the specified content (Figure 2). Despite the importance of that content, this research found that several screens worth of text can easily overwhelm users and lead them to dismiss the pop-up window, screen, or potentially the app. Rather than present the rules as a single expanse of text, separate the content into

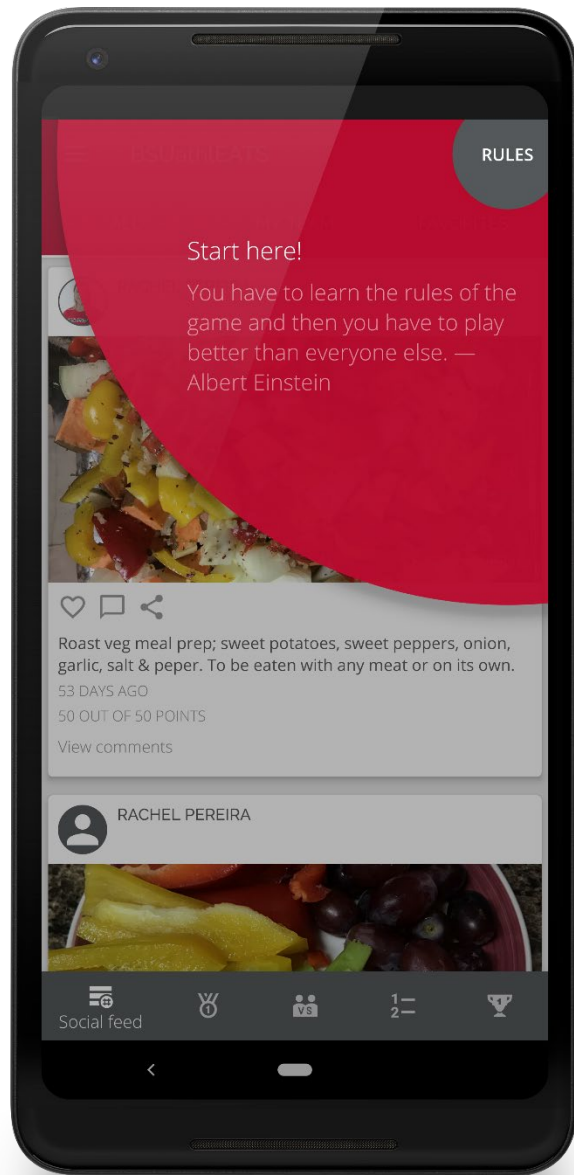


**Figure 1.** Onboarding screen with progress dots and login button.

smaller segments and present those on the screen or with the section where they are most relevant to the current task. This offers context and maintains a sense of relevance for the task, while reducing the overwhelming first-impression of the app. Users are also able to explore the app at their own pace and learn about the features. A selective use of formatting options like a heavier font-face or different text color can highlight key elements within the content. Both the onboarding process and the CTA should appear automatically the first time users install the app or visit a screen as to not distract or disrupt subsequent uses of the app. Menu options in the side navigation drawer or in an *About* or *Settings* screen can provide access to the full content once users have an opportunity to experience the app and later seek particular insight or guidance on how to use a feature.

### *Navigation*

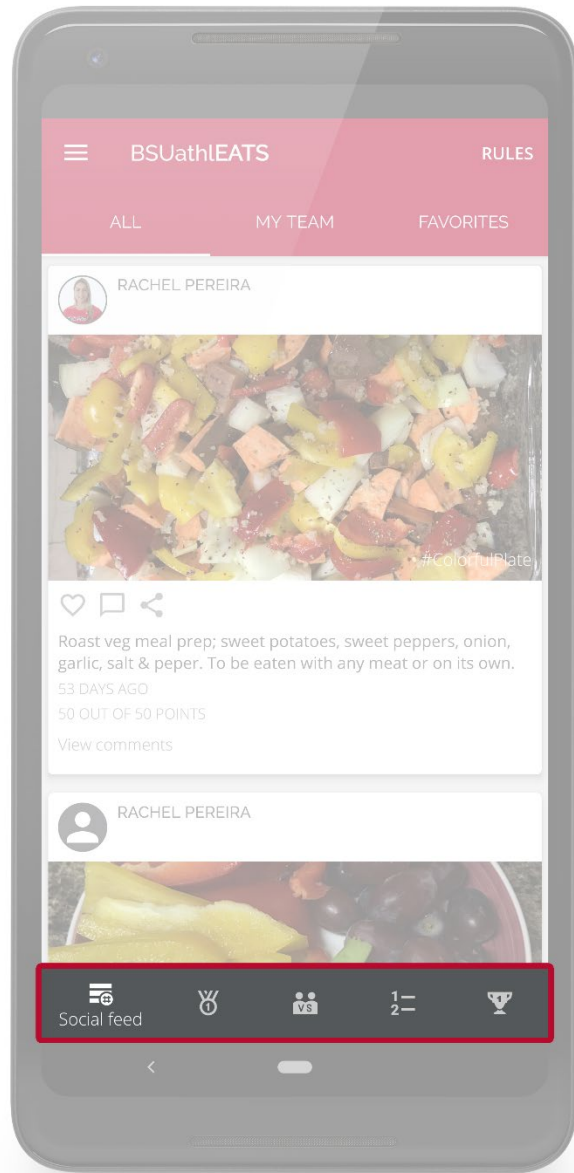
Iconography is a key navigational element in nearly every user interface. Typically presented without text to clarify the intent or purpose of the icon, it must stand alone and



**Figure 2.** Call-to-action for RULES menu option.

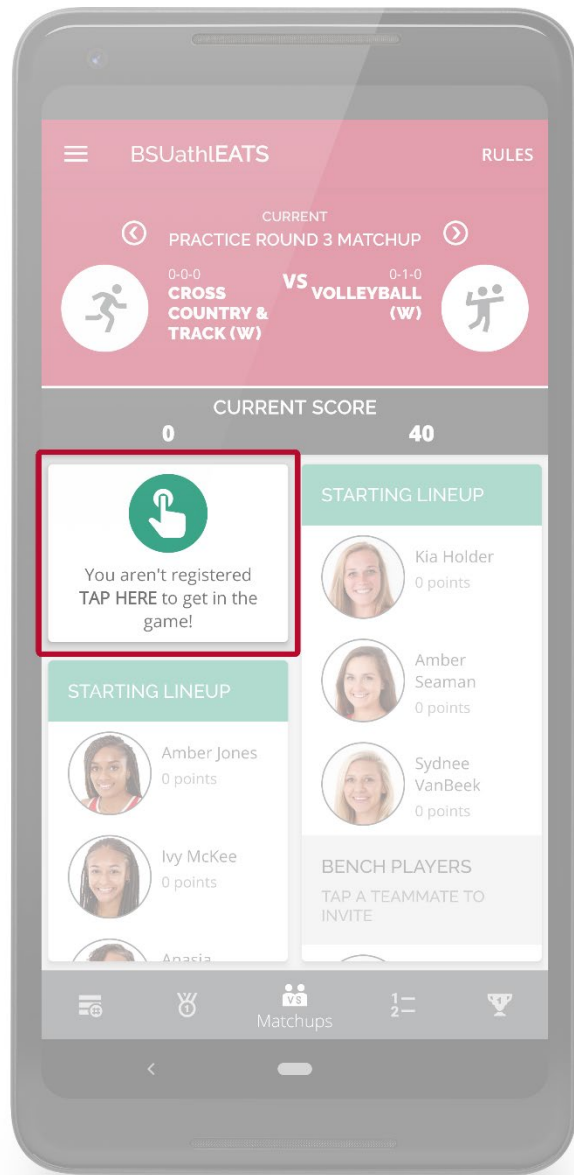
represent the action or function in a clear and meaningful way. For example, BSUathlEATS relies on five icons to serve as primary navigation for the app: the Social Feed, Leaderboard, Matchups, Standings, and Challenges/Point Quests (Figure 3). To create a connection between the form and purpose, the icons appear with descriptions of each section on the onboarding screens. A variety of icon packs and libraries are available online that adhere to the design standards for iPhone and Android app development, which currently recommend a flat and minimalist design in a solid color. A consistent bar at the bottom of each screen serves as the primary navigation and offers users an inviting opportunity to explore the app. This user interface component follows well-established design trends of thumb-based navigation and preferences of Gen Z users.

Based on the findings of this thesis, frequently accessed functionality should appear within close proximity to the associated interaction. If missing, the initial reaction of users is that the functionality is not available and they feel lost as they have a greater tendency to remain on



**Figure 3.** Bottom navigation bar: Social feed, Leaderboard, Matchups, Standings, and Challenges/Point Quests.

the primary screens of the app. Although they may start tapping around the interface in an effort to locate the functionality, this does not offer a positive user experience. For example, two navigation issues were identified in BSUathlEATS. First, the gameplay for the app requires users to register for each bi-weekly competition round. The option to register appeared in the side navigation drawer rather than associated with each of the rounds on the Matchups screen. To resolve this issue, a “register to compete” option was added above the starting lineup for each round of the competition where users had not yet registered (Figure 4). Second, the profile screen contained a tab-based navigation component that displayed a gallery of recent



**Figure 4.** Registration call-to-action on the Matchups screen.

posts, badges earned through various activities during the competitions, and a round-by-round breakdown of the points earned. This setup was problematic for users. Although profile screens are a common part of many account-based apps, whether social media, games, sports, travel, or health and fitness, users view the profile screen as a static portion of the app that contains basic personal or account details with limited functionality and infrequent content updates. To resolve

this issue, menu options were added to the side navigation drawer for “My Gallery,” “My Badges,” and “My Points” (Figure 5).

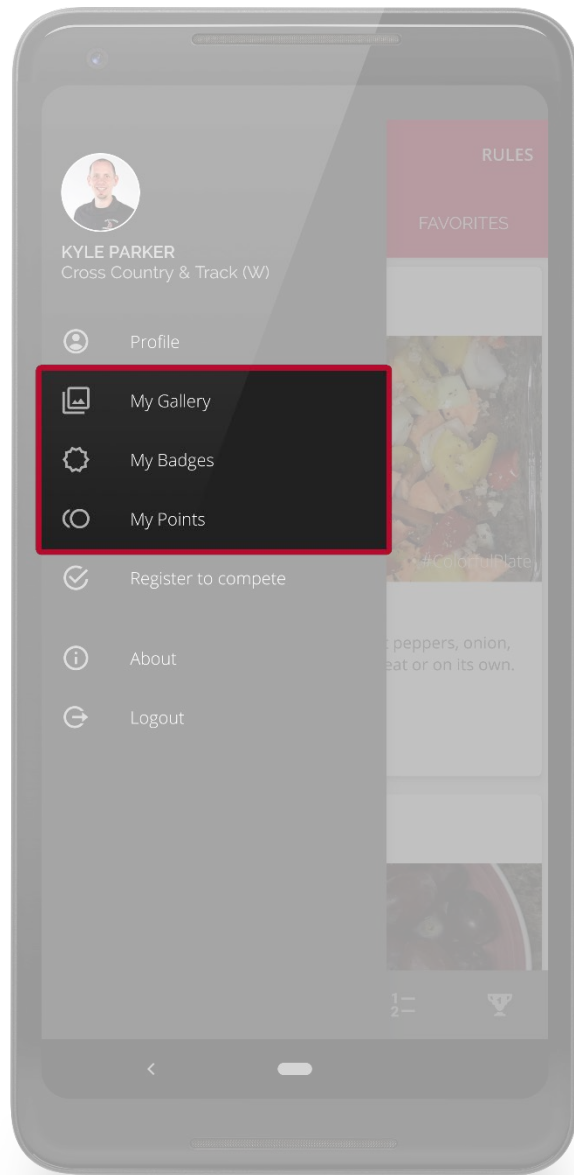
### *Notifications*

Notifications are an important component of an app that engage or re-engage with users through timely and relevant information along with a CTA for specific tasks within an app (Figure 6).

Typical mobile device owner have 90 or more apps installed, each of which seeks their attention. An app can easily become invasive and burdensome for student-athletes who lead busy lives with the demands of academics, practice schedules, matches and games, and social activities.

These considerations require a delicate balance to provide sufficient notifications to maintain engagement but not too many that

would lead to app uninstalls. To achieve this balance, functionality like a smart delivery queue, designed to combine multiple messages based on a similar topic or announcement, can provide a single notification rather than individual messages. Users should also have the ability within the

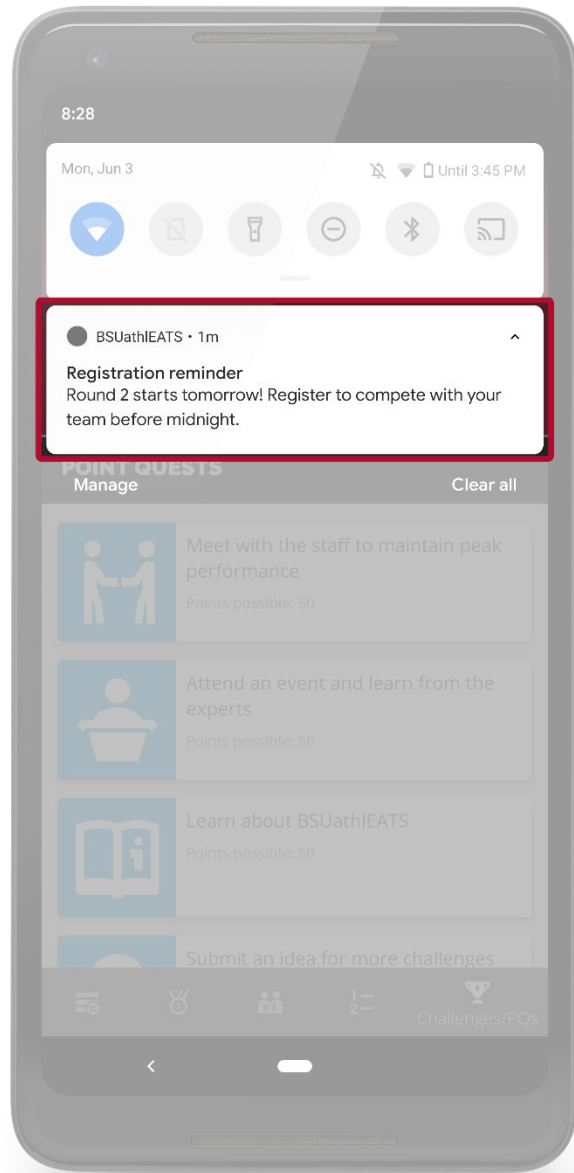


**Figure 5.** Side navigation drawer with separate menu options for *My Gallery*, *My Badges*, and *My Points*.

app to modify subscriptions for each notification type and adjust the delivery frequency to manage the potential interruptions and distractions.

### *Crash Reports*

Crash data and problem reports collected by the cloud-based services like Google Firebase offer developers an opportunity to review and analyze issues for severity and resolve issues in the app. Highly engaged and interested users may reach out to developers to report a problem, whereas the majority would either ignore the crash, avoid the functionality that caused it, or abandon the app. These issues can result in bad reviews on the app stores and negative perceptions about the stability and quality of an app. Automatic data collection ensures developers are notified and have an opportunity to address problems and release updates to mitigate future problems with current and new users.



**Figure 6.** Registration reminder notification sent the night before the next competition round.

## **Social Engagement**

Regarding RQ2 — To what extent do the social aspects of BSUathlEATS affect users' perceptions of enjoyment, engagement, and usability? — this research identified the social media habits of student-athletes as the primary consideration related to engagement. In addition, several recommendations for improvements are identified for the next iteration of app development. Prior to the study, it was hypothesized that social media platform features like posts, comments, sharing, and liking would appeal to the student-athletes as members of Generation Z. However, feedback from the participants and data collected from the mobile app provided a different perspective on the views and attitudes toward social media.

### ***Social media habits***

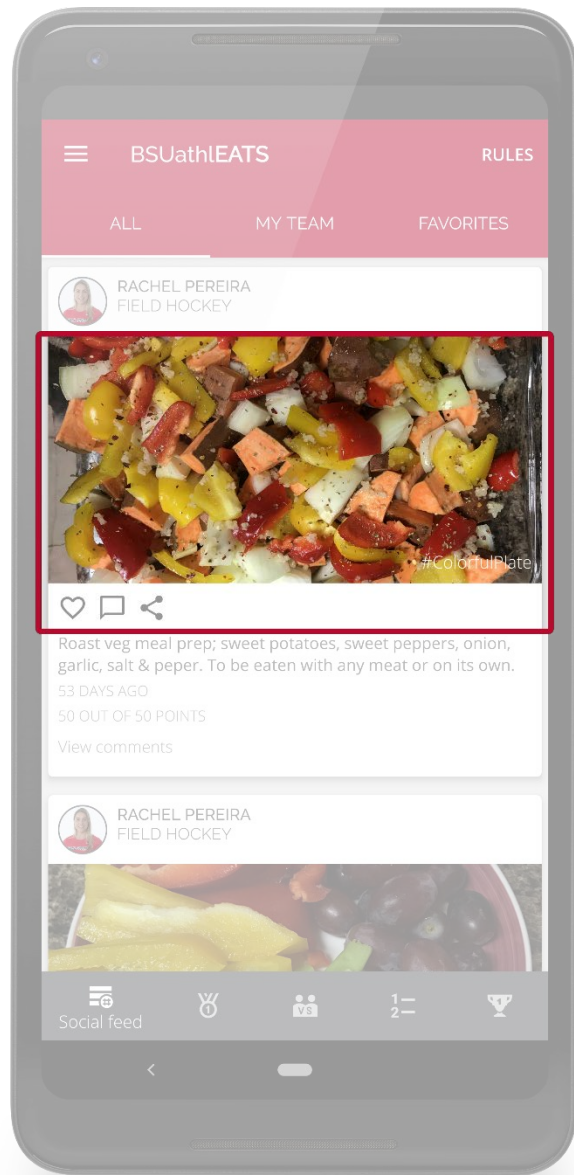
This research identified two unexpected findings that shifted the perception of the social media habits of student-athletes and the reliance on standard social media platform features. First, the student-athlete's general disinterest and minimal interaction with social media. Whether due to personal preferences, schedule demands, or university policies, social media platforms like Facebook, Snapchat, Twitter, and Instagram are not a significant part of their digital lifestyle. They may use one or two platforms, but accounts are kept private, interactions limited to friends and family, and engagement and posting are infrequent. Ball State Athletics has a social media policy for student-athletes and although it is not as strict as other universities, there are potential penalties for abuse and inappropriate posts. Second, if they do use social media platforms, the communication beyond friends and family is typically one-way. They post or view content but sharing, liking, and commenting are not frequent activities that drive their engagement or interactions.



For apps that incorporate elements of social media and target college student-athletes, it is crucial to understand and embrace these attitudes and perceptions. Rather than view these as limiting factors that discourage involvement, there is an opportunity to focus on the features that offer a compelling experience, like the ability to find new recipes and ideas for meals and snacks. While posting photos to the feed is social in nature, users are not required to comment, like, or share (Figure 7). There are opportunities to earn points for those activities as part of the competition, but the overall experience does not suffer if users abstain from those activities. These considerations can help guide marketing and promotional efforts and identify the proper features to highlight as an app launches for general use.

#### *Additional recommendations for improvement*

This thesis identified three recommendations to improve the social feed and related functionality: reconfigure the tabs to better organize and present the three groups of posts, create a “hashtag collection” to showcase recent posts, and resolve display limitations to view the



**Figure 7.** Icons *Like*, *Comment*, and *Share* a post from the Social feed.

entirety of the posts. Although specific to BSUathlEATS, the rationale for these improvements are applicable for any app developer who seeks to create a similar experience.

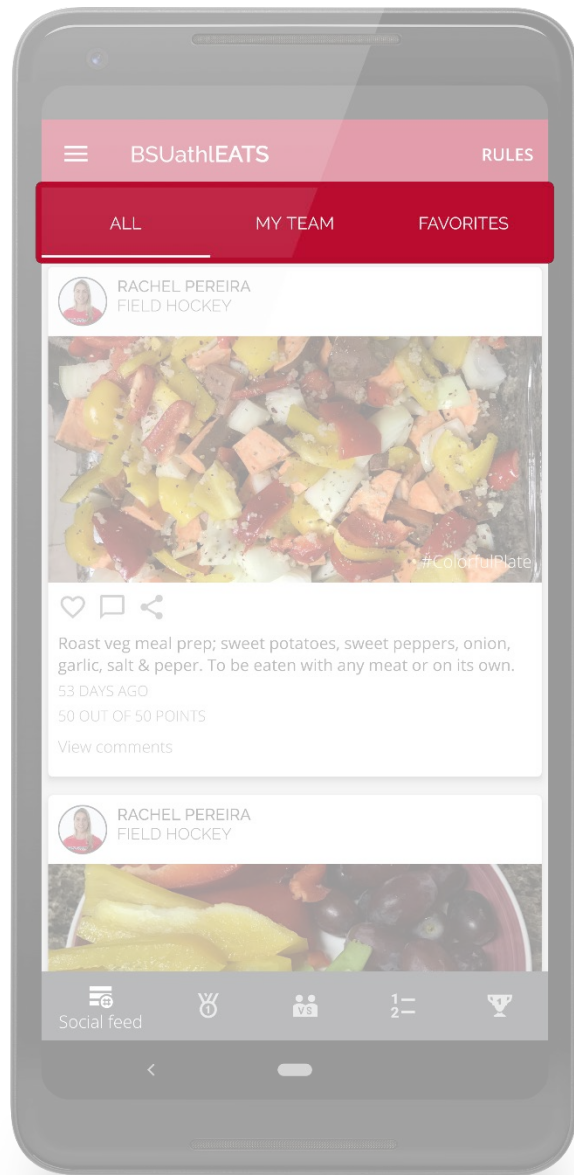
### *Social feed tabs*

The current version of BSUathlEATS features three tabs along the top of the posts: All, Team, and Favorites (Figure 8). To minimize the potential for overwhelming student-athletes with the list of posts, a new “Conference” tab will replace “Favorites.” This will provide an opportunity for student-athletes to check out the competition for future matchups within a conference and create a stronger sense of community among those teams. The “Favorites” tab, identified as a personal list

with infrequent access needs, will join “My Gallery,” “My Badges,” and “My Points” in the side navigation drawer. This will centralize all the personal details for the student-athletes.

### *Hashtag collections*

A new set of content items, like the “Stories” feature on Facebook and Instagram, will appear above the tabs and group posts based on the hashtags associated with the challenges.



**Figure 8.** Tab navigation for the Social feed: *All, My Team, and Favorites.*

These story collections will allow student-athletes to explore the posts for each challenge and provide a more dynamic view of the feed activity. A keyword search feature will be added to the social feed, further increasing the usability of the app and better alignment with user expectations. Users are more likely to search for a specific item than to scroll through a list of posts.

#### *Social feed post options*

The primary critiques of the social feed were the inability to view the full, uncropped photo from a post and read the full caption, which may have contained a recipe. In the next version, these issues will be addressed. To streamline user interactions and reduce the number of taps, student-athletes will have the option to comment on a post directly from the feed instead of from a secondary post detail screen. Like other social media platforms, student-athletes will also have the ability to tag others and those individuals will receive a notification that directs them to the post. An expanded text entry box will allow users to enter the full recipe for a meal or include additional details relevant to the post. Currently, the app limits this input to a single line of text and does not provide an enjoyable user experience or encourage communication.

#### **Competition**

Regarding RQ3 — To what extent do the competitive aspects of BSUathlEATS affect users' perceptions of enjoyment, engagement, and usability? — three primary considerations were identified, including a review of the structure for the Challenges, the importance and frequency of incentives, and feedback on the gameplay elements introduced in the app. Prior to the study, it was hypothesized that as athletes, features like the leaderboard, matchups, and challenges would appeal to their competitive nature. Although these features did attract the

majority of participants, others stated their chose sport offered enough competition and they did not need another source within their daily activities.

### *Challenges*

Challenges are the primary driver for competition and participation in the app. Photos captured for the challenges populate the social feed and encourage engagement from the other student-athletes. The gameplay for BSUathlEATS is designed to run for 13 weeks during the semester and maintain student-athlete involvement for teams in and out of season. Without compelling, meaningful, and engaging challenges, the app can become stagnant and unappealing to users. Apps that rely on user-generated content to motivate and encourage participation require app administrators to monitor feedback and usage statistics to ensure the prompts are relevant, plan and review the criteria for evaluation, and offer a variety of opportunities to connect with the most users, regardless of schedule or living arrangements. For example, student-athletes in-season will encounter different limitations and moments to compete than athletes in the off-season. This includes travel schedules and pre-game meals that offer restricted food choices. The same is true for on-campus student-athletes eating in the dining halls compared to those off-campus who cook their own meals. As a result, the combination, quantity, and complexity of challenges become important considerations.

### *Incentives*

While the opportunities to compete have a direct effect on the interest and involvement of student-athletes, the lack of incentives also play a strong role. The app and promotional materials must clearly define available incentives and the benefits available to student-athletes who compete. With the obligations and pressures of school and sport, bragging rights and the satisfaction of winning are not sufficient motivation. The expectation to compete for an entire

semester was doubtful. To address these concerns, the mobile app, website, and marketing for the BSUathlEATS project must include incentives at the forefront of the promotions. Student-athletes should understand what they could earn by sacrificing their time and energy to compete week after week and feel excited by the possibility of winning the top prize. With more than 450 student-athletes, the opportunity to reward more people is also a factor worth consideration. Frequent incentives throughout the competition would also appeal to student-athletes and encourage ongoing participation. The competition schedule must also account for the demands of their respective sports – certain points throughout the semester will require strict focus on not only athletics but also academics. If student-athletes are penalized for these breaks, it could negatively affect their desire to continue the competition.

### *Gameplay elements*

The leaderboard is typically a core component of a gamified app. Although it may discourage competition as much as encourage it. For the competitive and engaged users, the leaderboard serves as a frequent source of motivation through a desire to attain and maintain the top position among the other competitors. As a result, this can increase their participation, frequency of use, and overall enjoyment with an app. However, for student-athletes who are in the middle or bottom of the leaderboard, it can become a source of demotivation to compete. They may view the point differential as an insurmountable obstacle and the app quickly loses appeal. To account for this constructive and destructive force within the app, the app should offer opportunities to level the playing field without eliminating the overall competitive nature. Recommendations for improvement to a leaderboard included the ability to filter the list to encourage a more granular sense of competition among teams or groups. If a user cannot earn the

top spot among all competitors, there may be motivated to best the teammates or other group members.

This thesis identified unexpected feedback related to badges on the profile screen. Although the functionality was not fully implemented, the available badges offered the basic structure planned for the full launch. Student-athletes were not interested in the badges as they offered no compelling value to the overall competition or tangible incentives like points or rewards. Future development efforts must evaluate whether to remove the feature from the app or continue to collect and analyze feedback from other users.

### *Team captain*

On a smaller scale, competition within a team can create an opportunity to improve the enjoyment and engagement of an app like BSUathlEATS. One method is through the concept of a team captain. On the field or court, the team captain is responsible for leading the team through a love of competition and motivation for fellow players. In an app experience, the rank of team captain translates into an incentive offered to the top point earner during each round of competition. While bragging rights and the team captain badge may offer sufficient motivation for some, familiar concepts can create additional value. For example, the team captain could have the ability to substitute and underperforming player with someone from the bench. On the field or court, if the actions of an individual negatively affect the performance of the team, that person usually is pulled from the competition and someone else takes their place. The same scenario holds true for the head-to-head matchups of competition rounds. BSUathlEATS calculates team scores based on the average score of all registered student-athletes on the roster. If someone does not contribute, the team is affected. This feature can foster a sense of accountability for every team member, encourage frequent interaction and engagement by the

team captain, and offer an incentive to bench players who may have missed the registration deadline for that round. As an additional incentive for the team, points could be awarded for each remaining substitution at the end of the competition round.

## **Nutrition**

This research identified support for the student-athletes to reach their health and performance goals as an important theme related to their enjoyment and engagement with BSUathLEATS. Comments and feedback from student-athletes reinforce the need additional resources and highlight the importance of expert-curated content to provide recommendations for meals and recovery, details on macros and specific dietary requirements, and meal preparation tips. The inclusion of this content will also help educate the student-athletes on the choices they make related to their health and nutrition and provide a better foundation from which to engage in the competition and contribute to the social experience.

## **Conclusion**

Competition and incentive-based mobile apps like BSUathLEATS have the potential to serve as a valuable resource for student-athletes to improve their health and nutrition. Unlike other offerings on the app stores, BSUathLEATS provides an opportunity to share recipes and find inspiration for meal ideas, learn from others and improve eating habits, compete for bragging rights and incentives, and ultimately become better athletes for their respective sports. Inspired by social media, fantasy sports, and games, it is not another food tracker, calorie counter, or activity log. BSUathLEATS represents another tool athletic departments can use when presented with limited budgets for nutritionists, dietitians, refueling stations, and state-of-the-art facilities. There are issues to overcome before a widespread launch, including the implementation of recommended improvements, marketing and promotions to generate

excitement among the student-athletes and staff, careful planning for the Challenges and Point Quests offered, and compelling incentives to motivate and encourage student-athletes. In addition, it is well known that athletes are competitive. However, based on responses from the participants of this study, there are limits to that competitive drive.

A critical mass of teams and student-athletes is necessary to create relevant and meaningful content for the social feed and provide motivation to complete challenges and compete against other teams. Social media platforms are built on a sense of community and group participation. Without users to contribute content, others will not have a reason to engage. Likewise, if users do not engage, others will not have a reason to contribute content. Compelling challenges and point quests are necessary to drive that participation throughout the competition rounds. It is important to offer a variety of opportunities for student-athletes to participate, as it increases the likelihood of sustaining the program, offers more diversity for the social feed, more flexibility based on the student-athlete's academic and athletic schedules, and more opportunities to improve their health and nutrition. Incentives are also an important part of the motivation to compete and are necessary throughout the rounds. The functionality, social aspects, and competition are not sufficient to sustain interest and engagement throughout the semester until the final winners are determined. One potential scenario: after each round, the top scoring team and individual would receive a reward, or some other factor that alternates from round to round.

Apps like BSUathLEATS will not appeal to all athletic teams, nor will it appeal to all student-athletes. This was evident during the recruitment process for this thesis. Football, men's basketball, men's baseball, and several other teams did not respond to a request for participants sent to their university email address or respond to requests from administrative staff and teammates. During the second study, one participant stated: "Athletes who are playing the game



are already on top of their nutrition and health - the app isn't going to change that. Athletes who don't care about their nutrition aren't going to care about the app." This is a reality for most apps on the market. Although with the right combination of functionality, social engagement, and competition, this study has shown that there are student-athletes who are excited and interested in an app like BSUathLEATS.

### **Future Work**

The sample size of the study was relatively small and only targeted student-athletes who were willing to participate. When considering a launch for more than 450 student-athletes across 17 teams, the number of participants, amount of content generated, and ability to administer the system will likely affect the perceptions of enjoyment, engagement, and usability. This study targeted student-athletes not currently in season. How the structure of the competition, Challenges, and Point Quests play out during a full semester when student-athletes are practicing, competing, traveling, and studying throughout the week was not adequately tested. As several participants stated during the study, the quality and intent of the Challenges and Point Quests will have a direct effect on the interest and ability to incorporate the competition into their schedules. The usability study conducted for this thesis included limitations that adversely affected participation and the responses from participants. The Point Quests were not fully implemented as the majority offered a simple placeholder that indicated how the activity would function after the app launched. This eliminated opportunities to check-in for a lecture on health and nutrition, visit the staff to discuss meal plans, respond to a survey, or complete the other available Point Quests.

As originally planned by the graduate students who developed the concept for BSUathLEATS, a website would complement the functionality of the mobile app with video

blogs from nutritionists, recipe sharing among the student-athletes, simple food trackers to share with trainers, the ability to submit questions to staff, and other resources. This thesis identified the common perception that the app was a fun distraction, but it did not provide a significant source of actionable or relevant information. Future work in this area could include the development, curation, and testing of this website in conjunction with the mobile app to determine whether the interplay between the two resources would provide mutually beneficial outcomes. This thesis lays a foundation for understanding how functionality and design, social media components, and competition affect the perceptions of enjoyment, engagement, and user experience of BSUathlEATS. Once the app launches for all student-athletes, further studies could evaluate those perceptions with feedback from a larger and more diverse group of participants who compete for a longer period and receive incentives as the individual MVP or winning team. Additionally, this app may have commercial appeal to other universities that seek opportunities to support and motivate their student-athletes to increase their performance. Insight from other institutions could offer compelling data and resources to promote further research in this area of study.

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**Appendix A: Free-form responses from SUPR-Qm Survey #1 and Survey #2**

<i>SURVEY 1: SUPR-Qm survey free-form responses</i>
<b>Q23: Describe what you like most about the app and why.</b>
I like how you're grouped with your team competing against other teams.
It's not just a food log. It's competitive and almost can serve as social media
It look neat and organized, not all over the place and messy.
I like the different challenges that can take place, and I enjoy being able to see what everyone else posts.
I like how you are able to compete against other by completing activities.
Visual ideas of people's meals that you may be able to make in the future.
You get ideas about what you could cook
I like the simplicity of the app and the interaction we have with other students, seeing what they are making to eat and how they are getting their protein
It is really easy to use which makes me more likely to use it
I like being able to see how my nutrition compares to that of other athletes.
seeing everyone's food
I like seeing what other athletes eat because it gives me new meal ideas
I like the competition aspect of the app.
I like that it is a competition against other teams.
I like to see what other athletes are eating. It gives me ideas to improve my diet
<b>Q24: Describe your primary motivation for downloading the app.</b>
Wanting to help the launch of the app for athletes.
To help a study
I wanted to be helpful and test it out for my team next year.
My motivation was simply to help and see if there can be any nutrition changes or incentives for athletes in the future.
The trial



Wanted to see other ideas. And to always watch what I am eating
The competition. To see what other athletes eat. Get ideas on what to cook.
I was asked to be a participant in the trial run of the app
To try and beat people in challenges in ways like eating healthier
Responsibility to the beta testing
incentives
My teammates were doing it
I am part of the study.
I was interested in a nutrition app.
to win the competition
<b>Q25: What features do you frequently use on the app? Please be specific.</b>
I use the leaderboard and matchup most often.
I take picture of my food the most
Scrolling through the social feed to see what people are eating and the point quests tab to see what there is to do.
I look at the feed quite a bit, but I also like to see if there are other challenges that have changed. I tend to look at other teams scores and what theya re doing to get points often as well.
The feed - looking at everyone's posts, looking at the leader board
Posting food pictures and viewing what other people are making.
What other people post. Post meals
I use the social feed the most, to see what other people are posting. I also used the matchups page frequently to see how my team is doing.
The standings and looking and double checking the challenges
Playing the “games” to get points but it’s hard to be competitive when the “prize” is theoretically so far in the future. I would probably lose interest after a month or so
posting pictures
I’m mostly on the social feed

I use point quests.
I look at the PQs/Challenges, scores, and the things people post.
I upload pictures to get points, I don't know what else there is to do on the app.
<b>Q26: Under what circumstances do you use the app?</b>
Generally when I am eating a meal and want to see if it qualifies for a challenge.
When I make healthy food
When I am eating healthy to update it.
I use the app when I am curious about the scores, but also I like to look at the app for food ideas that I haven't tried yet.
Sometimes it is random, sometimes I use it when I have a nice meal or a challenge
To post on the challenges and to check points.
Usually in the evening after practice
I use the app to post photos of my meal, to check my teams standing and to get recipe ideas from other athletes.
To figure out how many points my team and I have and to double check what the challenges for the week are
When I'm bored or I remember to use it when I'm cooking or eating.
to gain points
To view a friend's post When I have something to post When I have down time, I just check in sometimes
I upload photos and check standings.
I use this app in my free time or when I want to post something.
when my teammates tell me about new ways to get points or things that they posted.
<i>SURVEY 2: SUPR-Qm survey free-form responses</i>
<b>If your responses changed from the first week, please describe why.</b>
It kind of gets boring to use the app because the app serves no important purpose.
They did not

The challenges in combination were difficult to accomplish since I'm not in season with my team, don't go to the grocery very often, and don't have a fruit costume/had practice during game times. I didn't check it as much because I knew I didn't have anything to post...it is more fun to be able to post challenges
I don't believe they have changed
I actually asked one of my teammates to join our team because she thought i was a really cool concept
N/A
My responses have not changed. I really enjoyed using this app and think it would be a fun thing to use in the future with my whole team.
I don't think my responses changed.
I think my answers are consistent with the first weeks answers.
I got more bored of the app.
Thought last week challenges were a little better and more clear
After a while I forgot about the app and didn't have anything to really post.
They haven't
My responses were similar
As time went on the activities became repetitive and I had no incentive to continue to go on it. I eventually forgot about the app.
<b>Q23: Describe what you like most about the app and why.</b>
You get ideas about what you could cool
How easy it is to use and see others challenges completed
I like the set up of how it is a competition with other teams - it's fun to compete
Everything looks neat and organized, so it doesn't take long to find the page you are looking for.
It almost plays as a social networking app because you can compete with other athletes you know
seeing everyones posts
I like that you can see everyones posts, and that it is a competition

I like that it is a competition and I like seeing things people posted.
Like the first week, I like how easy it was to see what other athletes were eating and it was interesting to see how many colours people could use in one meal.
I like the social feed.
Other people ideas and what I can make.
I liked to view other athletes post, because I've always been curious about healthy food options.
I really like the challenges, but some of them are tougher than others and the multiple entries per challenge might make people less interested in being competitive.
I liked being able to see how other athletes diets compared to my own habits.
It's a cool idea and competition between the sports teams is fun.
<b>Q24: Describe your primary motivation for downloading the app.</b>
For the study
To compete with other teams
for the test run
Wanted to help
Forces me to eat healthier
incentives
To help test out the app
I wanted to see what the app was like.
I was asked to participate in the trial study
I was part of the study.
To be part of the team with my own soccer team
I was curious and knew that some of my teammates were doing it.
Wanting to help with the study
To be part of the survey
To help out with exploring the new app

<b>Q25: What features do you frequently use on the app? Please be specific.</b>
I look at the posts other users make
The challenges and the leaderboard
the feed with everyone's post, the leader board, and the match-ups
Posting point quests and challenges
I used the comment and like buttons a lot because it was easy points. I also received most of my points from posting pictures of my meals.
pictures
I use the feed, watching what other people are doing, and I enjoy seeing what I can make that would match up with what the challenges are in the app.
I check the scores and click on challenges.
Like the first week I primarily use the home page to see what people have posted and the team standing to see how my teammates are doing.
I upload photos.
Check points and add pictures or comment
Most of the time I used the app to view the food posts.
Leaderboard and matchup
Posting meals that I made or recipes I have used
Posting pictures of meals
<b>Q26: Under what circumstances do you use the app?</b>
When I'm bored
To look and challenges and see where our competition stands
when I have something to post or when I am eating and want to see what other people have posted
When I know that I can.
When I make healthy meals but when I do not eat healthy I don't use the app.
whenever

I use the app to post about my meals and to check the feed when I am bored.
I use it when I am bored or when my teammates tell me to.
I use the app to see what others are eating and to see where my team is standing in the competition as well as to see my personal rank.
I upload photos and participate in competitions.
Comment on posts and to get points
When one of my teammates bring it up, I found myself opening the app up then,
When I'm eating and curious what people's scores are.
When I'm bored or when I get obligated because I was part of the beta testing
When a friend talks about new things they found.